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ENVIRONMENTAL RADIATION PROTECTION REQUIREMENTS FOR NORMAL OPERATIONS OF ACTIVITIES IN THE URANIUM FUEL CYCLE

FINAL ENVIRONMENTAL STATEMENT

VOLUME II

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U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation Programs

40 CFR 190
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VOLUME II

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation Programs

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IX. RESPONSE TO COMMENTS

This Chapter of the Final Environmental Statement addresses all comment letters submitted on the Draft Environmental Statement. Notice of availability of the draft statement was published May 29, 1975, and the comment period expired on September 15, 1975. Testimony, both written and oral, received in connection with the public hearing on these standards held on March 8-10, 1976, and letters related to that hearing are not included here. These are addressed in other material issued by the Agency concerning this rulemaking. However, those materials were considered in framing the responses to comments contained herein.

Specific items of common concern to a number of commenters have been consolidated so that they could be addressed by a single response. Each comment is followed by code numbers to identify each of the letters which raised the issue covered by the comment. All of the comment letters are reproduced in the Appendix, together with an index which provides a guide to locating the comment letters by code number. A few very general comments which indicated only general agreement or disagreement with the draft statement or that were not accompanied by any supporting data or other arguments were not included. In addition, minor comments that address editorial errors and the like have been reflected in the final statement, but are not addressed here.

The comments are grouped by subject matter into several general areas of concern, which generally correspond to the organization of material in Volume I. The responses are intentionally brief, and make reference to Volume I and its supporting documents when more detailed technical information is appropriate.

A. SCOPE OF THE RULE OR THE ENVIRONMENTAL STATEMENT

COMMENT 1: The Environmental Statement should address the total potential impact of radioactive materials from the nuclear power industry, and describe EPA's total program for protection of the public from radioactivity from the entire fuel cycle. EPA cannot restrict the scope of its analysis because it does not believe its authority extends to all sources of potential radiation doses from the fuel cycle. (P-25)

RESPONSE: It is true that this environmental statement applies neither to the total potential impact of radioactive materials from nuclear power, per se, nor to EPA's radiation program as a whole, but rather to a specific proposed regulation limiting the public health and environmental impact of normal operations of the uranium fuel cycle only. The Agency believes that it is appropriate to address this voluntary environmental statement to the limited scope addressed by the proposed regulation. To do otherwise would be to imply decisions and judgments that are not being made by the Agency as a part of this proposed regulation.

COMMENT 2: EPA has not justified singling out the uranium fuel cycle for the establishment of generally applicable standards.

The standard should also address contributions to exposure from other fuel cycles, noncommercial fuel cycle use, non-U.S. fuel cycle use, atmospheric weapons testing by other countries, and/or research applications. (P-25,I-4,I-25,S-15)

RESPONSE: The standard addresses the uranium fuel cycle because this cycle comprises the overwhelming majority of current commercial nuclear power production activity in the U.S. Since the standard is based upon an analysis of the costs and benefits of exposure reduction for a specific set of related operations, those comprising the uranium fuel cycle, contributions to public exposure from other miscellaneous U.S. and foreign sources are not germane to that analysis. Other U.S. sources will be addressed by the Agency, to the extent that its authority permits, when and if they become significant sources of public exposure.

COMMENT 3: The standard should address the plutonium fuel cycle, since fuel reprocessing is unlikely to occur in the absence of use of recycled plutonium, and/or because of the urgency that this toxic material be addressed by environmental standards. (P-23,P-25,I-25,S-11)

RESPONSE: The Agency will consider modification and/or additions to these standards for nuclear power operations to cover the plutonium fuel cycle when and if that cycle is approved for commercial use by the NRC. A recent analysis (1) of the economics of the tail end of the fuel cycle by the industry indicates that recovery of uranium alone, without recycle of plutonium, is sufficient justification for the reprocessing of spent fuel. To the extent that plutonium exists as a part of the uranium fuel cycle, environmental releases of this material would be limited by the standard for transuranics.

COMMENT 4: The standards should include effluents from mining operations. It is not necessary for EPA to interpret the Atomic Energy Act in the same restrictive manner as has the AEC. (P-7,P-23,P-25,S-18)

RESPONSE: Liquid effluents from mining operations are covered under the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). Interim effluent limitation guidelines for uranium mines (40 CFR Part 440.53) were published on November 6, 1975 (40FR51722). Reinterpretation of the Atomic Energy Act to include mines would require redefinition of source materials to encompass lower concentrations of uranium and thorium than those presently covered. Such reinterpretation would then require licensing of mines by NRC or Agreement States, and through this mechanism EPA standards could be enforced. The Agency has determined that, for the present, to seek such a major change is not warranted. This situation will be reviewed when the need for future control of radon-222, the principal airborne effluent from mining, is considered by the Agency.

COMMENT 5: The final statement should include a discussion of EPA's views on whether a variance is being considered to "grandfather" mills which are presently not operating within the limits of the standard. (S-15)

RESPONSE: The standards apply only to doses delivered as the result of discharges of radioactive materials from licensed sites beginning two years following the promulgation date. Inactive tailings piles that are not on the site of active milling operations and therefore included in an active license for a uranium fuel cycle operation are therefore exempted from the standard.

Inactive mill tailings piles are the subject of joint investigation by the EPA and ERDA to determine the appropriate handling of these piles. This effort will determine the current condition of all inactive sites in order to provide the basis for recommendations to the Joint Committee on Atomic Energy with regard to legislation for remedial measures at these sites. The Agency anticipates that this program will adequately respond to the hazards presented by these inactive tailings piles. Further, these tailings piles are not covered under present licensing regulations of NRC. In order to include them under the standard, it would be necessary for NRC regulations concerning the definition of source material to be revised. Since we believe that the problems are currently being adequately addressed, we do not find that it is reasonable to try to have existing NRC regulations modified.

COMMENT 6: Effluents from low-level waste disposal sites should be included within the scope of the standard, since some sites have experienced releases beyond their boundaries, or plan release of radioactive materials as a part of their normal operation. (P-7,P-11,P-25,S-6,S-11)

RESPONSE: A basic goal for shallow land burial of radioactive waste is that the waste will not migrate from the burial site to the general environment. Thus, there should be no planned releases to be subject to the standard.

COMMENT 7: The effects of waste disposal cannot be ignored for long-lived radionuclides, such as iodine-129 and plutonium. These materials once separated cannot be just buried and forgotten. (P-1)

RESPONSE: It is true that some long-lived radioactive wastes will require management for extremely long periods of time. It is clear, however, that such management, even though it carries some possibility of failure, represents a major improvement over direct dispersal into the environment. The Agency is actively working with the Council on Environmental Quality, the U.S. Geological Survey, the U.S. Nuclear Regulatory Commission, and the U.S. Energy Research and Development Administration to achieve an optimum solution for the ultimate disposal of long-lived radioactive wastes.

COMMENT 8: The standard should include radiation exposures of the public due to non-operating facilities and due to the decommissioning of facilities. (P-25)

RESPONSE: The standard applies to normal operations of NRC and Agreement State licensees. This includes periods when facilities under an active license are not actually operating. It is the responsibility of the licensor to require measures to be taken that will provide assurance that exposure of the public will be minimal following decommissioning, before allowing a license to lapse. It is the Agency's expectation that such exposures should be well below those established for operating facilities by these standards. It would, therefore, be inappropriate to condone doses to the public at the level of these standards by including decommissioned facilities within the scope of these standards for normal operations of active facilities. The Agency will maintain cognizance of this issue and take appropriate action, if it appears necessary in the future, to insure that doses from inactive facilities are minimal.

COMMENT 9: The restriction of the standard to facilities only to the extent that they support commercial electrical power production could unnecessarily restrict its applicability. (P-25)

RESPONSE: The Agency believes the wording is clear. "Commercial electric power production" is simply electric power generated for commercial use. Any facility in the United States that generates or supports the generation of electric power for commercial use by means of the uranium fuel cycle would be subject to the standard, regardless of its owner or the nationality of its customers. The Agency does not believe that it is either appropriate or necessary to include research facilities within the scope of these standards, because the impact of these activities is minimal and an adequate basis for determination of appropriate operating levels does not exist.

COMMENT 10: The standard excludes milling of uranium bearing ores containing less than 0.05% uranium without justification. Future demand may require the use of such ore. (P-25)

RESPONSE: The comment is correct, and the restriction has been removed from the standard.

COMMENT 11: The standard should include limits on the release of carbon-14 and/or tritium. Such limits could easily be scheduled in advance of their actual implementation, as are the limits for iodine-129 and krypton-85. The final statement should also provide a thorough discussion of control technology for long-lived radionuclides, including carbon-14 and tritium. (P-14,P-18,P-25,S-2,S-4,S-6,S-15)

RESPONSE: The knowledge base is not yet adequate for the assessment of tritium and carbon-14 control technology that is required in order to establish equitable limits on the release of these materials. The Agency has studies of controls for both of these materials underway and expects to be able to make proposals regarding carbon-14 promptly, with consideration of proposals for tritium following at a later date. Control technology for those long-lived radionuclides covered by the standard is discussed in references 4 and 5, and a detailed discussion of krypton-85 has been added to this final statement (Section VIII-B). Control technology for tritium and carbon-14 will be discussed when standards are proposed for these materials.

COMMENT 12: Carbon-14 should be studied, but it is misleading to show potential health effects until more detail is known. It is recommended that consideration of health effects due to carbon-14 be deleted from the FES. (I-4,I-12)

RESPONSE: The assessment of carbon-14 pathways leading to exposure of human populations has been carried out at a relatively sophisticated level using a multicompartmental worldwide model (6). The principle area of current lack of knowledge regarding establishment of standards for this radionuclide is control technology, not potential health impact. The assessment of potential health effects is included in order to provide the basis for the Agency's commitment to future consideration of a standard for this long-lived radionuclide.

COMMENT 13: The standard should include a limit on the release of strontium-90, cesium-137, and/or radon-222. The present level of knowledge for control of these radionuclides is at least as great as that for krypton-85 and iodine-129. (P-1, P-13,P-25,P-27,F-2)

RESPONSE: The standard does not include specific limits on the quantities of strontium-90 (half-life 28 years) or cesium-137 (half-life 30 years) released to the environment because they are expected to be adequately limited by the dose limits for individuals. These radionuclides typically comprise only 10% or less of the total activity released in liquid effluents from reactors (no releases of these radionuclides are expected to occur from other operations). However, in light of the deletion of curie limits from Appendix I (in contrast to Appendix I as it was originally proposed) the Agency will maintain continuing cognizance of releases and environmental behavior of these radionuclides. If operational experience indicates that the releases of these radionuclides are higher than anticipated or that there is a buildup in the environment, the Agency will consider these facts during periodic review of the adequacy of the standard.

As discussed in the notice of proposed rulemaking for these standards (40FR23420), sufficient uncertainties are associated with our knowledge of both the health impact and costs and efficacy of control measures for radon-222 that the Agency does not consider it advisable to propose standards for this radioisotope as part of this rulemaking. The Agency has this problem under continuing study.

COMMENT 14: The standard should address accidental releases, as well as planned releases, since the former may have the largest public health impact and cannot be distinguished from normal releases after they have entered the environment. (P-11,P-13,P-19,P-24,P-25,S-15)

RESPONSE: Although accidental releases could have a significant public health impact and may, in some cases, not be distinguishable from normal releases, it is not feasible to include accidents within the scope of this standard, which has been derived out of a consideration of the costs and associated health benefits of controls over planned releases. Such an analysis of accidental releases has not been made. Protection against the consequences of accidents is provided by emergency response plans based, in part, upon Radiation Protective Action Guides recommended by this Agency.

COMMENT 15: Implicit in the duty to establish standards is the responsibility to monitor implementation and ensure compliance. The standards should address these aspects of EPA's responsibility for radiation protection of the public from nuclear power operations. (P-25)

RESPONSE: The Agency will review the implementation of these standards through review of NRC's implementing regulations and normally reported monitoring data, and by occasional EPA field studies at selected facilities. It would not, however, be appropriate to incorporate these functions into the standards themselves, since the responsibility for implementing EPA's standards rests with the NRC, not EPA. The Agency believes that the above procedures will adequately insure satisfactory implementation of these standards. (See, also, Comments 91, 94, 103, 104, and 107.)

COMMENT 16: The standard and the Final Environmental Statement should be modified to include provision for and analysis of nuclear energy parks. (P-14,I-6,I-13,I-14,I-22,I-26,F-5)

RESPONSE: An extended discussion of the relation of the standard to the nuclear energy center concept has been added to this statement (see Section VI-F). The recent NRC study "Nuclear Energy Center Site Survey" (NUREG-0001) implies that, based upon use of current LWR effluent control technology and projected energy center siting practices, the standard will be satisfied. However, the Agency recognizes that uncertainty must remain regarding any such proposals for the distant future, and will review any specific proposals that may be made and consider the need for revision of the standards in the future, if this appears to be necessary.

B. STATUTORY BASIS

COMMENT 17: The standards should be expressed in terms of population dose, or dose to suitable samples of the public, since this is properly the domain of EPA's authority, not individual doses, which are the responsibility of NRC. (P-22,I-4,I-9)

RESPONSE: There is no such limitation on EPA's authority. Reorganization Plan No. 3 of 1970, which transferred to EPA the authority formerly exercised by the AEC to set environmental radiation standards, specifically provides for "...limits on radiation exposures..." without qualification. In addition, this same authority was used by AEC, before it was transferred to EPA, to establish all of the 10CFR20 limits on individual doses.

COMMENT 18: The standards limiting the total quantity of specific long-lived radioactive materials entering the environment are not "generally applicable standards," since the designated isotopes are released principally from one type of operation only (fuel reprocessing), and because these limits depend upon the amount of power produced. EPA should, instead, limit the concentration of these materials in the environment. (I-19,F-4,F-5)

RESPONSE: The transfer to EPA of authority to establish generally applicable environmental radiation standards specifically provides for "...limits on...quantities of radioactive materials...." This authority does not require that a limited radioisotope be released from more than one type of operation or that the amount permitted be independent of the size of the operation. It should also be noted that several long-lived materials released from the fuel cycle are emitted from a variety of fuel cycle operations in any case (e.g., tritium and carbon-14). Limits on concentration would not provide adequate environmental protection, since they would not limit the quantity released and, therefore, the total impact of these materials.

COMMENT 19: The environmental analysis should include the impact on occupational workers and their progeny. (P-25,S-15, F-6)

RESPONSE: EPA's authority to establish environmental standards is limited to "...the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material..." and, therefore, does not include occupational workers. However, the Agency is presently reviewing the adequacy of Federal Radiation Guides and guidance for occupational exposure under its more general Federal radiation guidance authority. (See, also, Comment 85.)

C. RATIONALE FOR THE STANDARDS

COMMENT 20: Cost-effectiveness is useful for determining the most effective alternative to achieve an objective. However, a cost-benefit analysis is needed to justify the reasonableness of the objective. (I-24,I-3,S-15)

RESPONSE: The standard has as its objective the reduction of the potential public health impact of radioactive effluents from the uranium fuel cycle. The cost-effectiveness of various options to achieve this end were examined, and a judgment made that the limiting rate of spending appropriate to achieve this objective was in the range of 100 to 500 thousand dollars per health effect averted. Such a procedure will insure that the total (internal plus external) environmental and public health cost of the activity is minimized. A cost-benefit analysis has a different purpose. Such an analysis would attempt to determine the net benefit of the activity (production of electrical power by use of the uranium fuel cycle) by accounting for all costs, including residual external environmental and public health costs (at some level of control, such as that required by the standard). This net benefit could then be examined: a) to determine if it is negative or positive (in the former case the activity should be abandoned), and b) in comparison with the net benefits of alternative means (solar, fossil, or other nuclear fuel cycles) to achieve the same end (electrical power), so as to form a judgment on the most beneficial alternative. However desirable such an analysis might be, it is not germane to the process of choosing the appropriate level for standards to limit normal releases of effluents from a particular fuel cycle, a process which is merely one of the preliminary judgments required as an input to an overall cost-benefit analysis.

COMMENT 21: EPA should await the results of the EPA-sponsored National Academy of Sciences' study on cost-effectiveness methodology before proceeding. EPA should also await the promised NRC rulemaking to determine a cost per dose commitment standard for use in cost-benefit applications. Finally, EPA should join with NRC in this rulemaking to establish appropriate monetary values for reduction of radiation doses to the population. (I-4,I-13,I-25,S-15)

RESPONSE: The National Academy of Sciences' study is directed toward assessment of the benefits of radiation, not the cost-effectiveness of exposure reduction. It is therefore not germane to this rulemaking. The NRC interim assessment of a limiting value to be placed on partial assessments of population dose reduction within a 50-mile radius of a light-water-cooled reactor has not been reviewed or accepted by EPA as an appropriate measure of the value to be placed on total population exposures from the entire fuel cycle, or from radiation exposures in general. EPA and NRC are considering the feasibility and appropriateness of a joint effort to consider this or equivalent quantitative measures of the value of population dose reduction, but unless and until both the scope and timetable for such an effort are mutually agreed upon the applicability to this or future EPA and NRC rulemakings must remain speculative.

COMMENT 22: Appendix I uses $1000 as a reasonable dollar expenditure per man-rem for population exposure reduction. This would have been a better technical basis for establishing the standards. (I-14)

RESPONSE: EPA believes that placing a limiting dollar value on spending for the avoidance of health effects in large populations provides a more meaningful basis for deriving standards to protect public health than establishing a dollar value for a unit of dose. In addition, when translated into dollars per health effect avoided, $1000 per man-rem to the whole body yields a rather high value - $1,400,000 per health effect. It is not clear that this interim NRC value, which is higher by a factor of 3-14 than that used by EPA, is an appropriate limiting value for such spending. (See, also, Comment 20.)

COMMENT 23: The standards, in effect, represent an application of "as low as practicable." This principle was never intended to apply to the establishment of standards, but was intended, rather, as guidance to "...those responsible for irradiation of...members of the public." (P-15)

RESPONSE: A distinction must be made between numerical criteria intended for use as general guidance, such as the Federal Radiation Guides or the recommendations of various bodies associated with the scientific community and/or professional groups, and standards established by the Federal government for the regulation of an industry much of which is, as it should be in our free enterprise system, subject to the profit motive. The standards are not general radiation guidance; they are, instead, the doses to members of the general public which the Agency has concluded are appropriate maxima specifically for operations of the commercial nuclear power industry as it exists today. It would not be either fair or appropriate to leave such decisions to the managers of individual facilities. Operational use of the "as low as practicable" principle, although it is essential for encouraging good day-to-day health physics practice, provides no criteria for how "low" is "practicable," and does not adequately address environmental contamination by long-lived radionuclides.

COMMENT 24: The standards and their cost-effectiveness are not supported by the data and information in the draft statement. The maximum annual dose limits appear to be based on an analysis of the best performance capability of fuel cycle facilities. This is likely to be not cost-effective. (I-14, F-5)

RESPONSE: Data on the cost-effectiveness of typical controls required to satisfy the standards are provided in Section V-A and its associated references. Best performance capability is considerably better than these control levels (usually at least an order of magnitude better) and was not used as a basis for the standards, since it is generally not cost-effective, as the comment suggests.

COMMENT 25: EPA appears to be lowering environmental limits because the industry has demonstrated the capability to operate below present limits, rather than out of a need to provide public health protection beyond that now achieved by the industry. (I-16,I-17,F-5)

RESPONSE: The limits have been justified specifically upon the basis of the additional public health protection they would provide, and not on the basis of using best current technology regardless of the cost or the benefit derived.

COMMENT 26: Current Federal Radiation Guides coupled with existing NRC regulations are adequate to protect the public. There is therefore no need for the standards. (I-24,I-25,I-26,F-4,F-5)

RESPONSE: The Agency does not believe that the Federal Radiation Guides alone are adequate as standards for regulation of a major source such as the uranium fuel cycle. The reasons have been set forth in Section II of this statement. NRC regulations, such as Appendix I, in addition to not being standards, exist in the form of so-called "ALAP" design guidance only for light-water-cooled reactors, provide no upper limits on public exposure from reactor or any other fuel cycle sites, other than the unnecessarily permissive Federal Radiation Guides, and do not address long-lived radioactive materials.

COMMENT 27: The draft statement has not justified the maximum dose levels, since it is not shown how the information in the draft statement and supporting documents was used to arrive at the standards. (I-14,I-17,I-19,I-25,F-5)

RESPONSE: The Final Environmental Statement has been expanded to provide a more extended exposition of the relation between the capabilities of control technology, the benefits of reduced dose to individuals and populations, the costs of achieving these benefits, and the standards (see Section V.D.). In general, however, Table 3 of the statement specifies the dose levels attainable using typical cost-effective levels of control, and the standards in most cases simply reflect these levels plus consideration of the need for a margin of operating flexibility.

COMMENT 28: The objective of the standard is to "...assure protection of the general public from unnecessary radiation exposures...in the general environment." EPA should establish the standard to apply to a suitable sample of the population rather than to any member of the public. (I-4)

RESPONSE: These standards are not Federal Radiation Guides, which, in any case, also include numerical guides for individuals in order to provide protection to the general public. The definition of "a suitable sample of the public" is too difficult a problem for regulatory application in a standard of the kind proposed. Protection of the general public is believed to be quite adequately provided for, in any case, by the combination of individual dose limits and limits on quantities of long-lived radioactive materials to be released to the general environment.

COMMENT 29: The quantity of health effects potentially produced, whether Appendix I or EPA's standard is in force, is essentially equivalent. Therefore, the standard is not needed. (P-12,P-14,P-20)

RESPONSE: The potential health impacts of Appendix I and the standard are not the same (see Table 10). In addition, it is important to make a distinction between the guidance provided by Appendix I and the uranium fuel cycle standard. The former provides design objectives for radioactive material in light-water-cooled nuclear power reactors and specifies levels at which reporting and corrective action is required during operation, while the latter provides a standard for the entire uranium fuel cycle (excluding mines, transportation, and waste management). In addition, the standard limits the release of long-lived materials (Appendix I does not), which are responsible for the majority of the potential health impact of the fuel cycle.

COMMENT 30: The model used to determine the total population dose should have a cutoff point (generally considered to be less than 1 mrem/yr) below which the radiation dose to individuals is small enough to be ignored. For example, doses to populations beyond 80 km from the source, or beyond the time of plant shutdown should not be considered. In particular, holdup of krypton-85 is not justified since the average total body dose rate by the year 2000 is expected to be only 0.04 mrem/yr. (I-15,I-25)

RESPONSE: Radiation doses caused by man's activities are additive to the natural radiation background of about 80-100 mrem/yr whole-body dose to which everyone is exposed. It is extremely unlikely that there is the abrupt discontinuity in the dose-effect relationship, whatever its shape or slope, at the dose level represented by the natural radiation background that would be required to justify a conclusion that some small additional radiation dose caused by man's activities can be considered harmless and may reasonably be ignored.

For this reason, it is appropriate to sum small doses delivered to large population groups to determine the integrated population dose. The integrated population dose may then be used to calculate potential health effects to assist in making judgments on the risks resulting from radioactive effluent releases from uranium fuel cycle facilities, and the reasonableness of costs that would be incurred to mitigate these risks.

COMMENT 31: EPA used worldwide populations in deriving the health benefits of krypton control. Only United States population exposure should be used until there are international agreements on krypton standards. United States industry could be placed in an adverse marketing position because of the added cost of controls. (I-5,I-17,I-26,F-4)

RESPONSE: The Agency does not believe that domestic industry should obtain an improved marketing position at the expense of subjecting the world's population to a potential adverse health impact through the unrestricted release of a radioactive gas to the world's atmosphere. It is also not logical to limit the calculation of the health benefit of krypton-85 control to the U.S., or any other limited population, since the environmental distribution of krypton-85 cannot be similarly limited.

COMMENT 32: The standard requires the scheduled application of control technology on a commercial scale prior to a demonstration that the technology can limit releases to levels required by the standard. EPA should delay the standards on iodine, krypton, and mill tailings until the control technology has been shown to be effective or provide additional information to justify its conclusion that such systems will be available by 1983. (I-1,I-4,I-11,I-17,I-25, S-18,F-1,F-6)

RESPONSE: EPA has determined to its satisfaction that the required technology is either now available or has a high probability of being available well before the effective date of the applicable portion of the standard. Additional information on these points is presented in Section VIII-B and in reference 5. Furthermore, it is the policy of the Agency to provide as much advance notice of new requirements as possible, so that industry may have adequate time for advanced planning in order to minimize difficult and expensive retrofit situations. If it should develop that any of the controls required to implement the standard does not achieve expected performance capability at reasonable cost and in a timely manner, the Agency will take this into account in its periodic review of the standards and make any adjustment that appears warranted at that time.

COMMENT 33: EPA should not adopt regulations requiring krypton effluent controls not yet successfully demonstrated or commercially available. (I-1,I-4,I-11,I-15,I-17,I-25,S-18,F-1)

RESPONSE: Cryogenic distillation systems are presently being offered commercially for both light-water reactors and fuel reprocessing plants. The Brunswick boiling water reactor is using or about to use a cryogenic distillation system to treat its condenser air ejector offgas, while the Japanese are installing the same type of system on the Tokai-Mura fuel reprocessing plant. Exxon's Nuclear Fuel Recovery and Recycling Center will also incorporate a cryogenic distillation system as a prototype facility on an "as low as reasonably achievable basis." Therefore, it would appear that cryogenic distillation systems are now commercially available. With further development, selective adsorption systems could also be made available for fuel reprocessing plants. Thus, there is enough time before 1983 to determine whether or not these systems, which are being used or are about the be used, will be successful.

COMMENT 34: EPA should justify the statement that waste management is an improvement over dispersal. (S-15)

RESPONSE: This matter is discussed in Section VI-E. It is believed to be self-evident that containment and removal from the biosphere, with only a small possibility of accidental release, represents an improvement over unrestricted dispersal into the biosphere.

D. TECHNICAL ISSUES

1. Environmental Pathways

COMMENT 35: EPA environmental transport models are inadequately documented or of questionable validity. (I-4,I-5,I-15,I-23,I-25,I-27,F-5)

RESPONSE: The Agency believes that the models used in the analysis which supports the standard are valid and adequate for that purpose. These models are documented in the supporting documents entitled, "Environmental Analysis of the Uranium Fuel Cycle" (2-5) and are not, therefore, discussed in the statement itself. In instances where commenters have identified specific cases of alleged lack of documentation or validity, these are addressed in subsequent comments. However, the Agency believes that the documentation of models provided is adequately detailed to assess the validity of these results, which, in any case, can also be directly compared to other findings using alternative models, effluent measurements at operating facilities, and environmental measurements. While some individual parameters in EPA models may vary somewhat from certain parameters in other models, the overall results do not vary substantially in most cases.

In general EPA has used standard models in deriving its conclusions for these standards. They are not intended to be either overly conservative or liberal, but to be as representative as possible of actual practice and conditions. The Agency did not feel constrained to use models based on past practices if more recent information indicated that changes were justified. This was particularly true regarding dose conversion factors (i.e., for plutonium and uranium particulates) where basic data compiled by the ICRP in 1959 (7) has been superseded by more recent material. These departures from "standard" practice are noted in the supporting documents referenced above.

The Agency, of necessity, used generic models for each class of facility in the uranium fuel cycle to achieve a common base for the consideration of radiation doses and the capabilities of radioactive effluent control technology. Generic models are expected to provide a reasonable approximation to conditions at actual plant sites, but will not be valid for particular sites in the sense that if site-specific meteorological conditions, distance to nearest residence, local food pathways, etc. are substituted for model site parameters, then the projected doses are likely to be somewhat different from those calculated for a generic facility. Such differences may slightly alter the level of control technology required.

COMMENT 36: The validity of EPA environmental transport models is questionable because these models differ between various EPA documents, as well as with NRC models, such as those used to derive Appendix I values. (I-2,I-4,I-10,I-23)

RESPONSE: The Agency agrees that it would be desirable for the models used by the Agency in its analyses to be consistent in all documents. However, when documents are prepared at different times and advances in knowledge of parameters take place in the meantime, differences are inevitable. Two examples of inconsistencies in supporting documents (2-5) have been identified: 1) uranium dose conversion factors differ between references 2 and 5, and 2) iodine pathway and dose conversion factors differ between references 3, 4, and 5. These differences are discussed below in Comments 37 and 38.

The Agency does not believe that EPA and NRC models need be consistent for the purposes of justifying the standard. While use has been made of many of the source terms, diffusion equations, pathway models, and dose conversion factors used by the NRC, the Agency does not use these values when it believes that more accurate and recent information is available or when the use of more simplified models is, in its opinion, justified. For certain types of facilities, such as conversion, enrichment, and fuel fabrication facilities, and for calculation of the environmental dose commitment of long-lived materials, no NRC models are currently available.

COMMENT 37: The dose conversion factor for lung doses due to aerosols containing alpha-emitters is not consistent with the ICRP II and differs by a factor of two in different EPA publications. (I-23)

RESPONSE: In recent Agency analyses of doses from mills (5), the dose conversion factors for insoluble alpha-emitting aerosols in the lung have been reduced by a factor of two compared to previous analyses, because the effective half-life for such particles in the lung was reduced from 1,000 days to 500 days in accordance with what is becoming accepted practice. Accordingly, previous calculations (2) concerning the dose to the lung from the inhalation of insoluble particulate matter should be reduced by a factor of two. In addition to the changes noted above for mills, this change is also significant in the analysis of doses from conversion facilities (ref. 2, Section 3). The maximum dose to the lung of an individual living near a conversion plant using the wet solvent extraction process is now estimated to be 15 mrem/yr; and for a plant using the hydrofluor process, 35 mrem/yr. This class of facility is now likely to satisfy the standard with little or no additional control, depending on the exact parameters of the specific plant and plant site.

COMMENT 38: Iodine pathway and dose assumptions vary widely between different EPA reports, and are not consistent with NRC models. (I-23)

RESPONSE: Changes in many of the various iodine-131 milk ingestion pathway model parameters have occurred over the years for a variety of reasons. We discuss, as a typical example, those for an average infant. The ratio of iodine concentration in milk to that in pasture air has increased from 620 to 1200 pCi/liter per pCi/m^3 because the surface specific deposition velocity of 0.5 cm/sec initially used was found to be in error, and has been changed to 1.0 cm/sec. The grazing factor was changed from 1 to 0.5 because it is considered more realistic to assume cows are fed for half a year on stored feed. The milk consumption rate for an infant was reduced from 277 to 183 liters per year to account for the 38% of infants who do not consume cow's milk. The dose conversion factor has been increased from 0.015 to 0.020 mrem per pCi ingested due to updating of internal dosimetry assumptions, principally regarding the energy of the radiation emissions. The overall result of these changes has been to decrease the value of the dose equivalent rate conversion factor from 2700 to 1700 mrem/yr to an average infant per pCi/m^3 of iodine-131 in pasture air.

Similar changes have occurred in iodine-129 milk ingestion pathway model parameters. However, since the half-life of iodine-129 is extremely long, there is no decay of iodine-129 on stored feed and the correct value for the grazing factor for iodine-129 is unchanged at one. In addition, the dose conversion factor for iodine-129 changed from 0.023 to 0.026 mrem per pCi ingested due to updating of internal dosimetry assumptions. The overall result of the changes has been to increase the value of the dose equivalent rate conversion factor from 15,000 to 23,000 mrem/yr to an average infant per pCi/m^3 of iodine-129 in pasture air. None of these changes are large enough to significantly affect the conclusions upon which the standards are based.

COMMENT 39: The expected I-131 doses in the vicinity of a reactor have been found to be an order of magnitude lower than those calculated by models used in the Draft Environmental Statement, but the draft statement ignores this fact when estimating I-131 impact. (I-15)

RESPONSE: The Agency is well aware of recent field studies of iodine pathways and potential thyroid doses, having taken part in them jointly with the AEC (now NRC). Results of these studies at four reactor sites indicate that actual iodine concentrations in milk are at least an order of magnitude lower than those projected by previously used models for the milk pathway. The exact reason for this difference is not yet known; however, past models probably overestimated radioiodine milk concentrations because adequate attention was not given to the chemical form of the radioiodine (e.g., elemental versus nonelemental) and site-specific dispersion characteristics (e.g., plume rise and deposition rate). Realistic treatment of these parameters is expected to more accurately estimate radioiodine concentrations in milk in the future. Federal agencies are presently incorporating some of these changes into radioiodine-milk pathway models. Furthermore, the results of these field studies are taken into consideration qualitatively in the Final Environmental Statement (Section V-C) with respect to the environmental impact of iodine-131 discharges from reactors.

Conclusions leading to the values for the standards would not be altered by the use of a more liberal milk pathway model. Should present estimates of maximum thyroid dose prove to be conservative because of future changes in milk pathway models, then less, not more, control equipment will be necessary to meet the standard.

It should also be noted that results of these field studies may not apply to other facilities in the fuel cycle, because the results are a function of the chemical state of the radioiodine at the time of its discharge, which in turn is likely to be influenced by inplant conditions that are different in other fuel cycle facilities.

COMMENT 40: The environmental dose commitment estimates made by EPA should be clarified and more fully defined. (I-25,F-5)

RESPONSE: The environmental dose commitment has been previously defined in detail in reference 8 (Appendix A) and pathway assumptions described in reference 4, as well as in reference 8 (Section III-B, and Appendices B, C, and D). As more information becomes available concerning environmental pathways of long-lived radioactive materials and dose modeling the Agency will, if it is appropriate, revise its environmental dose commitment estimates. Until such time, however, the Agency believes that the present estimates, which use the best information currently available, are quite adequate for the assessments needed to provide the basis for these standards.

COMMENT 41: The analysis of the impact of long-lived materials is inadequate, since it omits all exposures of human populations beyond 100 years following release to the environment. (P-1,P-14,P-25,P-27,I-13,F-5)

RESPONSE: It does not appear to be feasible to calculate exposures for periods greater than 100 years, given the present state of knowledge of environmental pathways of most radioactive materials. In some cases, such as for tritium or krypton-85, there is a negligible possibility for additional impact on decisions for the appropriate levels of environmental releases, since almost all of the environmental dose commitment has been delivered in 100 years. In others there could be an impact on such decisions because of the extremely long half-lives of some radioactive materials. However, in all cases where knowledgeable judgment is possible for these radionuclides, the impact during the first 100 years exceeds that in any suceeding century. It should also be noted that in the case of the longest-lived materials covered by the standards (iodine-129 and the transuranics) the required level of effluent control is that achievable by the best available technology - i.e., further analysis could not reasonably result in a more restrictive standard in the near future. (See, also, Comment 79.)

COMMENT 42: Environmental transport models that consider very large areas, such as the eastern U.S., are not justified. Most of I-129 and transuranic releases deposit within a few hundred miles of the source because such particulate material is removed from the air by settling and rain-out. These effects are particularly effective when particulate materials are released at low elevations. (I-15)

RESPONSE: The Agency's environmental transport models for airborne releases of I-129 and the transuranics consider both regional deposition of these radionuclides (within 80 km of the point of release) and deposition upon the eastern half of the United States. While most of the radioactive material does deposit within 80 kms of the release point, the Agency believes it realistic to assume that a significant fraction of the material may remain airborne for considerably longer distances. The total population exposure is related directly to the product of the soil surface concentration and the population density, and increasing the assumed deposition area will decrease the soil surface concentration, but at the same time increases the number of persons exposed. As a result, the total population dose will remain approximately the same. In fact, the regional population density used in the Agency's model is slightly higher than the population density of the eastern United States. Thus, limiting the area of deposition to 80 km would increase the projected population dose, not reduce it. However, the calculation of total population exposure is relatively insensitive to the choice of deposition area, and the model used is judged to provide a reasonable representation of the actual situation.

COMMENT 43: The draft statement fails to take into consideration the experience at the Nuclear Fuel Services' reprocessing facility cited in BNWL-1783 which reports a 200-fold decline in I-129 content of milk samples in the year following cessation of operations. EPA, therefore, also assumes that I-129 is available for longer than 100 years without adequate reasons. (I-4,I-15)

RESPONSE: The Agency's calculation of the 100-year environmental dose commitment for I-129 uses a short-term first pass pathway containing air-deposition-milk compartments and a long-term pathway consisting only of plant uptake from the soil. These two pathways result in different milk concentrations of I-129. The difference, which is on the order of a factor of 200, accounts for the experience at NFS.

Over the long term, I-129 becomes available in all food products, not just in milk, because of its long half-life and measurable uptake in plants. It is expected that most environmental I-129 will not be available to plants for periods comparable to its 17-million-year half-life, because it will gradually be removed from the root-zone of soil by water runoff and further penetration into the soil. At a removal rate of 1% to 5% per year little I-129 will remain in the root zone after 100 years. Although some I-129 may remain available in the biosphere for exposure of populations beyond 100 years, because iodine is a readily soluble element, the population dose is expected to be much lower than that during the first 100 years. EPA did not base its calculations of the impact of I-129 on any doses that would occur more than 100 years following its release to the environment.

2. Health Effects and Dosimetry

COMMENT 44: EPA dose calculations for tritium should be lowered by a factor of three through the use of more reasonable assumptions as to humidity and atmospheric dispersion. (F-5)

RESPONSE: The Agency has carefully reviewed its tritium dose calculations and believes them to be correct. It should be noted that EPA's tritium model considers the dose resulting from absorption of tritium through the skin, in addition to that resulting from inhalation, which doubles the equilibrium amount of tritium in the body. Also, under chronic conditions, tritium will be incorporated into body tissue, as well as in body water; this will increase the whole-body dose by a factor of 1.5. The combination of these factors increases the total dose to three times that computed using incomplete simpler models that only consider the inhalation of tritium and its incorporation into body water.

COMMENT 45: Table 2 does not adequately present principle critical organs by radionuclide (e.g., carbon-14 bone dose exceeds whole body dose; bone, liver, and lymph are critical organs, as well as the lung for plutonium, as is skin for noble gases in addition to whole body). (F-5)

RESPONSE: The comment appears to be based on obsolete information. The criterion for inclusion in Table 2 was not organs selected as critical by the ICRP and NCRP in the 1950's, but rather the risk to humans as estimated from the 1972 NAS-BEIR report. Since man is 23% carbon and bone is less than 15% carbon, it is unlikely that the carbon-14 dose will be higher to bone than the total body under equilibrium conditions. Even if these doses were comparable, the number of health effects due to total body irradiation are a factor of 30 greater (per rem) than those due to bone irradiation. For inhaled plutonium, which is assumed to be released as an insoluble particulate effluent, the principal organ at risk is the lung, not bone or liver. Lymph nodes, though they receive a high dose, are not considered an organ at risk and have recently been specifically excluded by the ICRP as a critical organ. EPA agrees at present with this reasoning, since animal studies with inhaled particles do not indicate that radiogenic cancers originate in lymph nodes. Finally, the principal risk due to krypton-85 exposure results from dose to the whole body. As shown in the supporting documents (4), the skin cancer risk is small compared to the whole body cancer risk.

COMMENT 46: The environmental statement should include an analysis of doses to all types of biota, not just humans. (P-18,P-25,P-26)

RESPONSE: The Agency has followed the BEIR Committee reasoning that if individual humans are adequately protected, it is highly unlikely that any biological population in the environment will be adversely affected. Such strict criteria are not applicable to other biota where protection of populations, not individual members, is the chief concern.

COMMENT 47: The linear dose-effect relationship does not provide an adequate scientific basis for estimating the health impact of the standards. Without such a scientific basis the standard is not justified. (P-11,P-12,P-14,P-15,I-7,I-9, I-11,I-15,I-16,I-19,I-3,I-25,I-26,I-28)

RESPONSE: Estimates of health risk due to radiation exposure were established on the basis of the best scientific data and judgments available. In 1970, at the request of the former Federal Radiation Council, the National Academy of Sciences-National Research Council established the Biological Effects of Ionizing Radiation (BEIR) Committee. The Committee consisted of five subcommittees which examined: (1) general and societal considerations, (2) environmental effects, (3) genetic effects, (4) somatic effects, and (5) effects on growth and development.

In its report, submitted to the Agency in 1972, the Committee reviewed the available scientific data on risks at low levels of exposure to ionizing radiations; selected the scientific basis it recommends that the Agency use for establishing radiation standards; provided quantitative estimates of the risk to human health of low doses of ionizing radiation; and clearly delineated the interpretations and meaning that should be attributed to these recommended estimates of health risk. The Committee considered a broad spectrum of somatic, genetic, and growth and development bioeffects. These recommendations of the BEIR Committee were used to establish the health risk estimates presented in the draft statement. As recommended by the Committee, the linear, nonthreshold assumption was made for the relationship between doses at these levels of exposure and potential health impact. The Agency has also reviewed the subsequent radiation dose-effect literature and sees no reason at this time to depart from the recommendations made by the BEIR Committee in 1972. (See, also, Section VIII-C.)

COMMENT 48: The BEIR report extrapolates, by a factor of greater than 1000 in dose and by factors from 100 million to a billion in dose rate, from the level of observed effects to the levels encountered by the general population. However, no studies have demonstrated deleterious effects at these levels of naturally-occurring radiation, even in areas of high-level background. (P-12,P-15,I-2,I-11,I-19,I-25,I-26)

RESPONSE: The BEIR report acknowledges and discusses these factors, particularly in regard to low-LET radiation and dose-rate aspects. The Agency, at present, sees no valid reason to depart from the BEIR report estimates. It should be pointed out that radiation effects, including carcinogenesis, have been reported at doses 2 to 100 times the annual background dose for both high- and low-LET radiation. Chromosome abberations and other radiation effects which, if not health effects per se, are closely related, have also been reported at dose-rates slightly above background and in areas of high-level background for high- and low-LET radiations.

COMMENT 49: The data-base for estimating health effects should include animal as well as human data, and not be restricted to information considered in the BEIR Report. (I-11,I-13,I-17)

RESPONSE: Although the BEIR Report emphasized human data, it also considered relevant animal data. The primary reason for using human rather than animal data is that the former is considered to provide the most reliable information on carcinogenesis in humans due to ionizing radiation. The Agency believes that conjectures about the radiation dose-response relationship based upon experimental results for carcinogenesis in animals, and the extrapolation of such data to man for the purpose of making estimates of carcinogenesis in humans is subject to many uncertainties. These include the short life span of animals compared to man and differences in the specificity of animal and human cancers and, possibly, mechanisms of induction.

COMMENT 50: Estimates of health risk to non-U.S. populations, especially in underdeveloped countries, are grossly exaggerated because they are based on U.S. life expectancy. In a country where life expectance is 45 years, the risk is probably three times smaller. (P-16,S-18)

RESPONSE: The point is well taken, although we do not agree with the quantitative evaluation. The NAS-BEIR estimates of risk are based on U.S. vital statistics for 1967. Similar data are not available for developing countries. However, it is not clear that the error introduced by using U.S. data is very large. The relative risk of certain cancers is higher in some developing countries, which tends to counterbalance the effect of shorter life expectancy. It also cannot be assumed that life expectancy will not increase in the developing countries over the effective lifetime in the biosphere of some of the more significant radionuclides released from the fuel cycle. Much of the world's population already has a life expectancy comparable to that in the U.S. Therefore, in the Agency's judgment, the use of U.S. risk estimates is not unduly conservative for the purpose of estimating the long-term impact of radionuclides.

COMMENT 51: The linear hypothesis is not necessarily conservative or always prudent; several scientists have considered convex dose-response relationships which project more risk per rad at low doses. All identifiable and estimable uncertainties should be factored explicitly into the cost-benefit analysis in the final statement. (P-25,P-26)

RESPONSE: The Agency is aware that some scientists have proposed a convex dose response relationship and the Agency is closely following these studies. The Agency notes that currently none of the proposed convex relationships have been developed to the point of quantitative description that would permit risk estimation. Additional reasons for preferring to use a linear dose-response function are discussed in the Agency's Policy Statement on the relationship between radiation dose and effect (see Appendix B of Volume I). It is the Agency's judgment that neither upper nor lower bounds of risk can usefully be used in the cost-benefit balancing, since these span such a wide range, and, in any case, it is not possible to assign to them quantitative estimates of confidence. The risk estimates used are those judged to be most likely to be accurate on the basis of existing scientific knowledge.

COMMENT 52: The analysis of health impact should be revised to reflect a report by Dr. John Gofman, "The Cancer Hazard from Inhaled Plutonium," which predicts a much larger health impact than the health-effects estimates prepared by EPA. In addition, if Dr. Edward Martel's paper on "Tobacco Radioactivity and Cancer in Smokers," were properly considered, it might significantly alter cost-benefit ratios of the standards. (P-11)

RESPONSE: The Agency has carefully reviewed the health effects estimates of Dr. Gofman and believe that he has made errors in developing his estimates. Dr. Gofman takes, as a starting point, BEIR Committee results for lung cancer and assumes their estimate is based on the average lung dose, rather than the dose to the bronchial epithelium, as clearly stated in the BEIR report. This error leads to invalid conclusions. The Agency is aware of Dr. Martel's hypothesis and follows the results of his studies closely. His investigations are still in an early stage and information that would allow quantitative risk estimates, as are needed for cost-benefit balancing, is unlikely to be available for several years.

COMMENT 53: The estimates of health risk due to plutonium do not consider the hot particle problem or other recent analyses of the hazards of plutonium. (P-25)

RESPONSE: Estimates of health risks due to plutonium have been re-evaluated in view of recent controversy concerning the radiocarcinogenicity of inhaled plutonium. The Agency's initial judgment that the present practice of averaging the dose over the whole lung is sufficiently conservative has been upheld by a recent NAS study of the hot particle problem (9).

As noted in that report, it is current practice to evaluate risk of lung cancer in terms of observed human cancers in the bronchial epithelium following radiation exposure. However, inhaled particles give higher doses to the pulmonary region where the cancer risk in humans is less. Therefore, use of the average lung dose to evaluate lung cancer risks is considered to be conservative.

COMMENT 54: The radiation dose-effect relationship is probably concave in nature; and thus, the linear, nonthreshold hypothesis overestimates the health risks. Furthermore, the linear hypothesis is an oversimplification of more complex responses especially at low doses and dose rates. These considerations may make it inappropriate to base health risk estimates on assessments of population dose. (P-10,P-12, P-15,P-16,P-22,I-2,I-11,I-15,I-19,I-25,I-26,F-4,F-5)

RESPONSE: While some scientists believe that concave upwards dose-effect models (such as the sigmoidal, quasi-threshold, quadratic and dose-squared models) prevail due to repair processes or for other reasons, especially at low doses and dose rates where low-LET radiation is involved, this hypothesis has rot been generally accepted, particularly for radiocarcinogenesis. Caution should be taken not to confuse and translate many of the well-known radiation injury studies, where cellular, organ depletion and survival experiments demonstrate clearly that biological repair occurs, to the case of radiation carcinogenesis, because of the lack of knowledge of whether the same mechanisms apply. (See, also, Section VIII-C.)

It may be the case that an overall dose-response model should contain some degree of a dose-rate effectiveness factor (DREF) for low-LET radiation, as asserted, for example, in the Reactor Safety Study (10). However, introduction of a speculative and uncertain DREF before it is more fully comprehended and validated is, in the view of the Agency, not warranted by the evidence available at this time for the prupose of risk estimation for the establishment of standards to protect public health. As additional research is conducted and evaluated, however, perhaps use of a DREF to reduce estimates of health impact may prove to be appropriate, just as use of a multiple stress effectiveness factor to increase estimates of health impact due to synergistic bioeffects may be found necessary to fully describe the overall health hazards associated with radiation in the environment. The Agency will maintain cognizance of developments in these areas and, if it appears appropriate, will, in the future, propose any changes in these standards that would be justified by new scientific information.

COMMENT 55: Dose rate plays an important role in the evaluation of health risks, and has not been adequately considered in the analysis. (P-4,P-12,P-15,P-22,I-11,I-13, I-25,F-4)

RESPONSE: The Agency is aware that the variation of radiation health effects with dose rate is an active area of theoretical analysis and experimental investigation. However, as discussed at length in Section VIII-C, the Agency does not believe that current arguments to the effect that low dose rates will increase or decrease the NAS-BEIR risk coefficients are persuasive.

COMMENT 56: EPA did not include the "genetically-related component of diseases, such as heart diseases, ulcers, and cancer, as well as more general increases in the level of ill-health in its estimates of genetic effects." These effects are important and should be included in the analysis. (P-11,S-15)

RESPONSE: The NAS-BEIR report estimate of genetic effects employed by EPA includes many constitutional and degenerative diseases, as well as other diseases of complex etiology, although it is true that the genetic component of certain common diseases is not. A specific estimate of increase in general ill-health was not made, since the basis for a quantitative estimate of ill-health is tenuous. A substantial fraction of the actual risk due to genetically related ill-health is encompassed in the NAS-BEIR estimates of diseases due to complex etiology mentioned above, and is in any case judged most likely not to be so large as to affect the conclusions of the analysis.

COMMENT 57: Reference to "nonspecific life shortening" is inappropriate, since it is not included in the analysis and its significance at low doses is questionable. (F-5)

RESPONSE: The Agency agrees and this statement has been deleted from the final statement.

COMMENT 58: EPA estimates the cost of implementing the standard to be less than $100,000 per potential case of cancer, leukemia, or serious genetic effect averted, or $75 per man-rem. This translates to 750 cases per million man-rem, which would be viewed by many radiobiologists as a very high estimate. (P-21,I-2)

RESPONSE: The values quoted have been rounded, and were calculated based on 400 cases of cancer, plus 300 serious genetic effects or 700 cases per million man-rem (see reference 4, Appendix C). These are median values derived directly from the report of the National Academy of Sciences (11).

COMMENT 59: The EPA risk estimates are derived solely from the NAS-BEIR report and do not take into account other evaluations of risk, such as the 1972 UNSCEAR report, NCRP-43, WASH-1400, and draft documents which may be published by ICRP and NCRP. (P-14,I-4,I-6,I-9,I-11,I-13,I-15,I-17,I-19,I-20,I-21,I-23,I-3,I-25,I-26,F-3,F-5)

RESPONSE: The Agency has reviewed and considered all the published documents cited in the development of these standards, including NCRP Report No. 43 (12) and the 1972 UNSCEAR report (13). As outlined in the discussion of health risk (Section VIII-C), the Agency does not concur with all of the conclusions and inferences of NCRP #43. The Reactor Safety Study (WASH-1400) (10) had not been published at the time the standard was proposed. The scientific data used in WASH-1400, however, was not new, and thus was considered in developing the standard. The Agency has recently published a review of that study (14). The Agency's staff has not had access to ICRP and NCRP draft publications. However, the Agency believes it is not desirable to base Federal regulations on unpublished materials, which are not available to the general public and which have not withstood the test of peer review and analysis. The Agency also notes that risk estimates prepared by the UNSCEAR generally agree with those prepared independently by the BEIR Committee. While UNSCEAR did not advocate the use of their estimates at low doses and dose rates, they applied them in their own report to some of the effluent releases from the uranium fuel cycle.

COMMENT 60: EPA should use the "upper," "central," and "lower" bound estimates set forth in WASH-1400 for assessing health risks, including use of a dose-rate effectiveness factor.

Alternatively, the statement should indicate that its risk estimates are upper bounds, and that the true risk falls somewhere between zero and the values given in the draft statement. (I-15,F-4)

RESPONSE: The Agency has carefully reviewed the Reactor Safety Study and published its findings in reference 14 (see Comment 59). The estimates characterized as "upper bound," "central bound," and "lower bound" in that report are not supported by this Agency; the upper bound estimate refers to the lower range of estimates for the linear, nonthreshold dose-effect model; the central bound estimate is calculated using a dose-rate effectiveness factor, and the lower bound estimate assumes that a threshold dose for radiocarcinogenesis exists.

The Agency believes that a more balanced consideration should have been provided. This would have been accomplished if the upper, central and lower bound risk estimates were defined in terms that truly reflect the several dose-response concepts that have been proposed by the scientific community, namely: a) the convex upwards response, b) the linear response, and c) concave upwards responses. Since the report did not use such a balanced definition for each category, the estimates of health risks given are unduly biased toward lower estimates of risk.

The use of a dose-rate effectiveness factor for cancer induction in humans is not believed to be justified by presently available data; and thus the reduction in the estimated number of cancers by a factor of five, as compared to linear estimates, by the report is not justified. (See, also, Section VIII-C).

COMMENT 61: EPA should wait until the findings of several ongoing reviews of radiation risk are completed, including those of the NCRP and ICRP on dose-rate effectiveness and organ dose allocation. (I-11,I-13)

RESPONSE: Radiation risk estimation is an area in which considerable experimental and theoretical activity exists, and no final results can be expected in the foreseeable future. Awaiting the completion of any particular study would not, in the view of the Agency, be in the public interest if further delay in the promulgation of regulations would result. Such a policy could easily result in indefinite protraction of action, and is not necessary in view of the Agency's commitment to review its regulations at regular intervals. The Agency expects that future ICRP organ dose allocation recommendations will be in reasonable agreement with BEIR Committee results, although such allocation schemes are not appropriate to the problems addressed by these standards. The NAS has recently undertaken a review of the plausibility of dose-rate effects for radiocarcinogenesis for the Agency, but this study will not be completed until 1978.

3. Control Technology Capability, Costs, and Availability

a. General

COMMENT 62: EPA should solicit cost information from industry to establish realistic costs for use in the cost-effectiveness evaluation. Generally the costs used were underestimated and an incorrect factor for transforming equipment cost to installed cost was used. (I-4,I-5,I-15,I-16,I-25,S-18,F-6)

RESPONSE: The cost information used was derived from a number of sources, including industry sources, and is considered to represent costs typical for the dates the specific documents were prepared during the period 1972 to 1976. The factor used by the Agency to transform equipment cost to installed cost is the same as that used by the NRC in the Draft Environmental Statement for Appendix I (15) and currently recommended for use by industry in NRC's Regulatory Guide 1.110 (16). (Se however, Comments 67 and 68.)

b. Mills

COMMENT 63: Although mills can meet the standards based on consideration of mill stack discharges and available control systems for particulate materials, based on data from operating mills, the standards cannot be met for tailings. More information is needed in the Final Environmental Statement concerning the control of windblown releases from tailings piles. (S-15,F-1,F-4)

RESPONSE: EPA has reviewed the available literature concerning the 17 uranium mills operational in 1975. Based on this survey it is concluded that seven mills are already in compliance with the standard, while ten would require remedial measures of varying severity. For these ten cases a variety of demonstrated control methods are available to provide the temporary (or permanent) stabilization appropriate to assure that the standards are satisfied. (See, also, reference 5 for additional information on control measures for windblown releases from tailings.)

COMMENT 64: The control of mill tailings is not justified because the levels of emissions are so low that the standard hardly seems worthwhile. (I-3)

RESPONSE: EPA's analyses of the environmental impact of inactive uranium mill tailings piles, based on many studies over extended periods of time (17,18), indicate that levels of exposure resulting from emissions from such tailings piles are significant. It is, therefore, reasonable to assume (19,5) that emissions from active mill tailings piles are significant also, and there is no justification to exclude them from the standard on the basis that levels of emission will be insignificant.

c. Reactors

COMMENT 65: Because of the complexity of calculating the dose due to nitrogen-16 gamma radiation, and since this source is not covered in Appendix I to 10CFR50, it should not be a part of this standard. Furthermore, circumstances could arise for BWR's where the 5 to 20 mrem/yr direct radiation dose added to 5 mrem/yr whole body noble gas and a 10 mrem/yr critical organ liquid pathway dose would result in a site containing a single unit exceeding the standard. The EPA should indicate how the high dose levels at Nine Mile Point and Bailly nuclear power plants can be corrected. It appears that a redesign of the shielding would be warranted in this case. (I-25,S-15)

RESPONSE: It appears to be no more difficult to assess nitrogen-16 doses than those from any other source (see reference 5). The absence (or presence) of design objectives in Appendix I for specific types of radioactive effluents has no direct implication for this generally applicable standard. The Appendix I design objective dose of 10 mrem/yr to any critical organ via the liquid pathway is primarily intended to address thyroid doses from I-131. The whole body design objective dose for liquid releases (which is comparable to nitrogen-16 skyshine doses) is 3 mrem/yr. Recent studies at an 800 MW(e) BWR, with minimal turbine building shielding, indicate that at any point more than 500 meters from the center line of the turbine, in any direction, the annual exposure rate will be less than 10 mrem (20). Considering the probability of the maximum design level dose from both the liquid and gaseous pathway occurring at the same point, the probability of a plant operating at 100% of capacity and using realistic occupancy factors, EPA considers it highly unlikely that any individual could be subjected to anything even near 23 mrem/yr from a single unit 1200 MW(e) BWR plant.

The potential for high doses at Nine Mile Point and Bailly nuclear stations can be reduced, if necessary, through the provision of either restricted access or additional shielding, as appropriate (5).

COMMENT 66: EPA should consider, in its estimation of the monetary cost to society for implementing these standards, the added cost (extra shielding, greater setback of turbines from rivers, etc.) necessary to insure that multiple reactor facilities on the same site do not exceed the whole body limit of 25 mrem/yr, due to direct radiation from nitrogen-16 decay in the turbine buildings. (I-1,I-15,S-15)

RESPONSE: Although the Agency did consider the cost of shielding, it did not consider costs associated with providing greater setback of turbine buildings from rivers, since this is only one of many considerations to be evaluated in the siting phase of facility design. Costs associated with increased shielding and consideration of nitrogen-16 doses from multiple units on a single site are provided in reference 5. It should be noted that it is extremely unlikely that nitrogen-16 doses from different units will be additive, since the exposure field associated with this source falls off very rapidly with distance.

d. Reprocessing

COMMENT 67: The cost information presented in the draft statement for iodine controls at fuel reprocessing plants are low, and neglect some important items. These cost estimates should be revised and such additional factors as operating costs, storage costs and disposal costs should be included. (I-15,I-19,F-6)

RESPONSE: The Agency agrees, and the appropriate revisions have been made (5). Cost estimates for iodine control were based on the ORNL work (21) for mercuric nitrate scrubbers and on other investigators' early estimates (25) for AgZ adsorbers. The cost information that has now become available as a result of experience at the Barnwell plant represents the first real figures on capital costs for such systems at reprocessing plants. The Agency believes the costs from this experience are more appropriate for use in determining the cost-effectiveness of iodine control systems and cost data in the analyses have, therefore, been changed. The capital cost for scrubbers has been increased to $600,000 and for AgZ adsorbers to $1.25 million in the Agency's analysis. The operating costs remain constant, since no operating experience is available to validate revised costs.

Storage and disposal costs have been neglected in the Agency's analysis, since meaningful data on such costs cannot be developed until a determination is made on the final disposition of fuel cycle waste. However, since the additional iodine-129 waste that the standard will require be collected is very small compared to that which will be collected under current practices, the incremental cost of storage and disposal are expected to be insignificant.

COMMENT 68: For fuel supply and fuel reprocessing facilities, the cost estimates for effluent controls are low because of the older estimates used in the support documents. (I-25)

RESPONSE: The cost estimates contained in "Environmental Analysis of the Uranium Fuel Cycle" (2,4) were prepared on the basis of cost estimates available in 1973. Updated costs are supplied in "Environmental Analysis of the Uranium Fuel Cycle, Supplementary Analysis - 1976 (5)." The revised cost estimates contained in this document do not alter the conclusions upon which the standards are based.

COMMENT 69: Adequate cost estimates are not possible for krypton-85 control, since the removal technology has not yet been fully developed. (I-1,I-13,I-15,S-15,F-5)

RESPONSE: Adequate cost estimates are possible for at least one type of krypton-85 control, cryogenic distillation, as it is already being offered commercially for reactors and fuel reprocessing plants. (See Section VIII-B and reference 5.)

COMMENT 70: The costs of krypton-85 removal systems should include structures, shielding, design, engineering, testing, and other such nonequipment costs. (I-4,F-5)

RESPONSE: The Agency has performed an exhaustive reevaluation of the costs of krypton control, which includes the above items. (See Section VIII-B and reference 5.)

COMMENT 71: The cost of krypton control should include waste storage and long-term disposal. (I-4,I-5,I-13,I-15,S-15,F-5, F-6)

RESPONSE: Until a final determination is made concerning the ultimate disposition of radioactive wastes from the nuclear industry, it is premature to estimate the cost for krypton storage and long term disposal. However, because of its relatively short half-life (10.8 years) compared to other long-term wastes, these costs should be only a very small fraction of the total cost for ultimate waste disposal.

COMMENT 72: The 40-year equipment lifetime assumed in the analysis of effluent control at fuel reprocessing (4) is inappropriate for krypton control equipment. (I-4)

RESPONSE: The comment is correct, a 40-year lifetime is probably inappropriate for krypton control equipment. In the updated analysis of krypton control technology (5), a 20-year equipment lifetime has been assumed.

COMMENT 73: Krypton removal is not cost-effective, based on its projected impact on the U.S. population alone. (I-17, I-19,F-4)

RESPONSE: Since krypton-85 is a noble gas, it is rapidly dispersed into the entire world's atmosphere and has no significant environmental sinks. Since dispersal of krypton-85 cannot be limited to the U.S. atmosphere, it is not appropriate to consider the cost-effectiveness of control of this radioactive gas on the basis of its impact on the U.S. population alone.

COMMENT 74: EPA should provide a cost-benefit analysis in terms of $/man-rem for krypton-85 removal. (S-15)

RESPONSE: Cost-benefit analyses are most meaningfully carried out in terms of the actual benefit achieved, in this case the reduction of health effects, rather than in terms of a surrogate, such as population dose. However, such an analysis is contained in Section VIII-B of the Final Environmental Statement (as well as in previous material).

COMMENT 75: Cryogenic removal of krypton-85 carries the danger of accidental releases of krypton-85 through the potential for inplant explosions. (I-4)

RESPONSE: Accidental releases of krypton-85 are not included under the provisions of these environmental radiation protection standards for the uranium fuel cycle. Nevertheless, designers of cryogenic distillation systems are aware of the potential for explosions and systems are designed to minimize the possibility of such accidents. Specifically, some designs provide for complete removal of oxygen from the system, while others provide for oxygen and hydrocarbon removal on a continuous basis from those streams with explosion potential.

COMMENT 76: The limits on I-129 should be increased to 40 mCi/GW(e)-yr to reflect technology that is expected to be achieved on a routine basis for fuel reprocessing. Decontamination factors of 100 are more likely than the 1000 anticipated by EPA. This would allow a period of performance evaluation after which EPA could re-examine the standard. (I-4)

RESPONSE: Conformance with the limit of 5 mCi/GW(e)-yr (0.225 Ci/yr or 1.4 kg/yr for iodine-129 from a 1500 MTHM facility) by 1983 will require a plant decontamination factor (DF) of no less than 300. This would be readily achieved by utilization of iodine evolution followed by the iodox process. Successful achievement of this level of cleanup without use of the iodox process will depend to some extent upon future operating experience with less sophisticated systems. Present estimates of their performance are quite conservative because of a paucity of operating experience, especially regarding their performance with iodine-129. However, it is anticipated and highly probable that DF's greater than 300 for iodine-129 will be achieved by 1983 using appropriate combinations of scrubbers and silver zeolite, since a variety of options are available for improving, if necessary, the conservative levels of performance currently projected. (See, also, reference 5.)

COMMENT 77: The 0.5 mCi/GW(e)-yr transuranic limit is unrealistically low. The standard should be increased based on past experience and prospects for transuranic control technology. (I-15,I-25)

RESPONSE: A typical filter installation consists of a prefilter (roughing filter) followed by two HEPA filters in series or by a HEPA filter and a sand filter. The prefilter generally has a rating of greater than 75% (Group III for 1.0 micrometer particles) and offers a considerable cost savings by reducing mass loadings on the more costly HEPA filters. The HEPA filters themselves are rated at a minimum efficiency of 99.9% for 0.3 micrometer particulates. The reported efficiency of deep-bed sand filters for submicrometer particles is greater than 99%. Thus, the overall decontamination factor for the filters themselves should be considerably in excess of 10^3, which when combined with the anticipated separation factor of the process itself between liquid and air phases of 10^6, leads to an overall process decontamination factor in excess of 10^9. These estimates are based on a well-established technology. Releases under actual performance are, therefore, expected to be no more than one-half the standard.

There may have been some misinterpretation of the wording of the standard by some commenters. Only alpha-emitters with half-lives greater than one year are subject to the standard and Pu-241 is, therefore, only to be considered to the extent that it is an alpha-emitter ($2.3\text{x}10^{-3}$%).

COMMENT 78: The limit set for transuranics is so low that very minor by-passes or miscellaneous losses at reprocessing plants would result in exceeding the limit. In addition, some portion of allowable releases will have to be assigned to reactor effluents, which result in reducing even further allowable releases from reprocessing plants. (I-25,F-4)

RESPONSE: It is not evident that minor by-passes or miscellaneous losses of transuranic contaminated process streams would lead to discharges of such transuranics to the environment in excess of the limit. While losses from process streams containing high concentrations of these hazardous materials could possibly occur, it does not follow that these materials will be discharged to the environment. Good design practice provides for the collection and treatment of such losses as waste. Since the operating philosophy and practice in waste management is containment of waste, no planned discharges of waste are contemplated by this standard.

The potential for discharge of transuranics from reactors is not anticipated to be a problem, since the only releases of transuranics measured to date from BWR's are about 1 curie per year of neptunium-239, which is a beta emitter and has a half-life of 2.35 days. Neptunium-239 decays to Pu-239 and if the neptunium is considered to be converted to plutonium the release rate of Pu-239 is less than 1 microcurie per year, or less than 1% of the standard. Unless additional evidence regarding transuranic discharges from reactors is found, the contribution of this transuranic source can be considered negligible and, thus, neglected.

4. Cost-Effectiveness

COMMENT 79: Doses and potential health effects are summed for 100 years, yet operating costs are present worthed. Unless doses or health effects are treated on an equivalent basis, then annual costs should be summed and not discounted. Thus, the costs are understated. (I-25)

RESPONSE: The use of present worth methodology for expressing the current value of a future train of dollar costs is well-established in economic theory. However, the question "what is the value society places or should place on avoiding a death or serious impairment of health - as a function of how far into the future it occurs," is not directly addressable within the context of economic theory. It is clear that there is no intrinsic theoretical basis for application of the exponential function associated with present worthing of future dollar costs to this problem, which is, essentially a moral or an ethical one. The Agency has taken the view that, to the extent that such projected health effects can be reasonably well projected (and 100 years has been judged to mark the limit for such projections), no devaluation is appropriate; and for periods beyond this timeframe, no quantitative assessment can usefully be made. Although the above bases are recognized as somewhat arbitrary, they are considered to be not unreasonable for the purpose of making the judgments required to establish these standards to protect public health.

COMMENT 80: The risk reduction items shown in Figure 3 have a slope of approximately $500,000 per health effect. The methodology for arriving at the stated $100,000 per health effect should be presented. (I-26,F-5)

RESPONSE: Considerations bearing on the range of acceptable costs for risk avoidance are discussed in Chapter IV. The example quoted ($100,000) was specifically for the removal of long-lived radionuclides covered by the standard. As a result of new information generated since the Draft Environmental Statement was prepared, cost estimates for krypton-85 removal systems have been increased, and it is now estimated that the cost of implementing the standard for this material at newly designed facilities will be on the order of $150,000 per health effect averted. Costs for a facility that must be backfitted may be up to a factor of two or three higher. Section VIII-B of the Final Environmental Statement and reference 5, contain detailed discussions of these revised cost estimates.

COMMENT 81: Shielding for turbine shine and means for reducing transportation doses should be evaluated on a cost-effective basis. (I-15,F-5)

RESPONSE: Turbine shine results primarily in individual and occupational doses; it does not produce an appreciable dose to populations. For those rare instances in which additional shielding may be required to reduce public exposure to satisfy the standards, therefore, the requirement is based upon consideration of equity to individuals and the small cost of providing this protection. An evaluation of costs for reducing transportation doses is difficult because the principal mechanism of dose control is through operational measures, such as preventing unnecessary public access to shipping casks by avoiding stop-overs in public places and routing shipments through sparsely populated areas. Such operational measures can be carried out at small cost.

COMMENT 82: Figures 3 and 4 in the draft statement are not clear. There is insufficient information to show how the figures were derived, the use of mils/kwh is misleading, the basis for the choice of systems is in error, and the cost of base case controls has been omitted. (I-15,I-25,I-26,F-5)

RESPONSE: These figures are intended to be illustrative of the types of systems available to achieve effluent control throughout the uranium fuel cycle. A far larger number of systems were examined and discussed in the technical support documents (2-5). The figures are intended to display only the basic characteristics of the cost-effectiveness of various major types of effluent control for the fuel cycle.

The display of costs in terms of mils/kwh is shown for perspective only and was not the basis for selection of the standards.

The choice of a zero point for the horizontal axis of these figures (or "base case") does not alter the conclusions drawn from them, as long as there is a clear statement of the starting point of the calculations. Any facility handling radioactive materials must have some degree of effluent control, and the amount has varied in time. The base cases assumed were those typical of operation at the end of the last decade, or prior to consideration of Appendix I for reactors. Except in the case of light-water reactors, the cost of base case controls is assumed to be zero. For liquid effluent control at reactors, the base case includes the cost of tankage to provide minimal holdup before release. The estimated present worth per GW(e) of base case controls for liquids at PWR's and BWR's is $0.3 million and $1.1 million, respectively. In addition, for the control of noble gas effluents at BWR's a nominal 30-minute delay line and 100-meter stack was assumed for the base case, as this was formerly a typical design practice; this system was estimated to have a present worth of about $3.5 million. However, with improved offgas treatment designs (i.e., charcoal adsorption, principally) costs that would have applied to the old 30-minute delay and 100-meter stack system would now be invested in an improved offgas treatment system. These considerations would shift the horizontal scale of Figures 3 and 4 by $0.3 million for the PWR case and, at most, $4.6 million for the BWR case.

E. IMPACT OF THE STANDARDS

1. Health and Environmental Effects

COMMENT 83: The growth of commercial nuclear facilities projected by EPA appears to be overestimated by about 50%, this thereby overestimates the health benefits claimed in the draft statement. More recent estimates should be used. (I-4,I-13)

RESPONSE: Estimates of future growth of nuclear power have changed considerably during the past few years. The projections used in the draft statement were those current at the time it was prepared. The final statement has been revised to explain the choice of the growth projection now used and the implications of other possible projections.

COMMENT 84: The risk of storing krypton-85 should be evaluated. (I-4,F-5,F-6)

RESPONSE: The risk of storing krypton-85 has been evaluated by the Exxon Nuclear Company, Inc., in its preliminary safety analysis report for a fuel reprocessing facility submitted to the NRC January 28, 1976. For the case of the instantaneous release of a storage cylinder containing 940,000 curies of krypton-85, it was estimated that a whole body dose equivalent of 15 mrem and a skin dose equivalent of 140 mrem would result at the site boundary. These estimates of dose equivalents appear reasonable and are well within (by two orders of magnitude) the 10CFR100 regulations applicable to power reactors.

COMMENT 85: The limits on quantities of effluents do not consider the costs of increased overall population exposure through higher worker exposure. (P-14,I-15,I-19,S-15,F-5)

RESPONSE: Occupational doses should be limited to the lowest practicable levels independently of requirements for the control of public exposure, through the provision of capability for remote handling or by shielding, as is appropriate. In general, however, it is not believed that these standards would have any substantial net impact on occupational doses. In some cases the standards should have the additional benefit of reducing occupational doses (e.g., at mills and at those reactors where additional shielding for turbine shine is required). In others, occupational doses may increase (e.g., as a result of krypton-85 and iodine-129 control), although it is anticipated that such increases will be small. The cost estimates for control of these materials include provision for remote handling and shielding, which will minimize occupational exposures.

COMMENT 86: EPA has not considered atmospheric effects of krypton-85 in proposing these standards. (P-5)

RESPONSE: As a result of comments on these proposed standards and testimony at public hearings held on March 8-10 in Washington, D.C., the Agency has been made aware of possible atmospheric effects of the uncontrolled release of krypton-85 to the environment. While it is presently difficult to quantify these effects, they do not appear to present an imminent hazard. Although the standards are based upon the direct potential public health impact of ionizing radiation from krypton-85, they should also serve to prevent any possible atmospheric effects as a side benefit. The Agency will remain cognizant in this area and reassess the effectiveness of these standards as more information develops on this potential aspect of krypton-85's environmental impact.

2. Implementation

COMMENT 87: EPA has presumed that the NRC can easily implement the standard. It appears that implementation could impose a significant administrative burden on the NRC without a significant change in environmental impact. EPA should provide an implementation plan to substantiate the feasibility and practicality of implementation. (P-14,I-1,I-13,I-15,I-25, I-26,S-15,F-4,F-5)

RESPONSE: The Agency has considered the basic elements required of an implementation plan (see Section VIII-A), and concluded that a significant administrative burden would not accrue to NRC.

COMMENT 88: There is no provision in the standard to require that the regulatory body consider the cost-effectiveness of the regulations they might set. (I-17)

RESPONSE: Although it is presumed that NRC will consider the costs associated with any implementation requirements they impose, EPA has also made clear its conclusions that these standards can and should be implemented without imposing any substantial additional costs (Section VIII-A).

COMMENT 89: The implementation schedule or plan should be developed jointly by EPA, NRC, and ERDA. There must be coordination between the Federal agencies involved before the standard is issued. (I-15,I-19,I-25)

RESPONSE: The feasibility of implementation has been examined by the Agency, as well as by other affected government agencies. It is the conclusion of the Agency that implementation is readily achievable by methods similar to existing NRC requirements (with small modifications in some cases) at light-water-cooled reactors. It is, therefore, considered neither reasonable nor desirable to delay issuance of these standards pending development of detailed implementing regulations.

COMMENT 90: Alternative implementation plans including economic and environmental impacts must be provided in the environmental statement in order to comply with the National Environmental Policy Act of 1969. (I-13,I-20)

RESPONSE: Since the environmental and economic impact of proper implementation is judged to be negligible, a discussion of alternatives would not be useful, and is not required.

COMMENT 91: Procedures should be provided for EPA review of regulatory agency implementation of the standard and industry compliance with the standard. The procedure should ensure that the information be reported to the public and the Congress. (P-25)

RESPONSE: Such procedures will be initiated when the standards become effective. EPA will request annual reporting from NRC on the state of compliance, and will report to the public in its ongoing annual report on the "Quality of the Radiological Environment." The Agency will also continue to review NRC regulations implementing the standard and to conduct detailed environmental studies of selected nuclear facilities.

COMMENT 92: The standards should be delayed until NRC establishes the necessary implementing rules, and, in particular, should be delayed pending completion of the implementation of Appendix I to 10CFR50. (I-8,I-9,I-17)

RESPONSE: Development of implementation procedures cannot logically precede development of the standard being implemented. Appendix I implementation is expected to be completed within the three-year period provided for implementation of these standards for reactor units, with the exception of the updating of models, which can be expected to continue on an indefinite basis. (See Section VIII-A.)

COMMENT 93: Implementation will involve costs which were not addressed in the draft statement or support documents and are not reflected in the cost-effectiveness evaluations. (F-4, F-5,F-6)

RESPONSE: Implementation costs are judged to be essentially the same as or comparable to those already required by the NRC of its licensees. (See Section VIII-A.)

COMMENT 94: EPA should review the NRC analytical dose models used to implement the standard and indicate possible modifications for doses to "real people." It is impossible to determine accurately the actual doses to specific individuals. (I-15,F-4)

RESPONSE: The Agency routinely reviews NRC dose models and will continue to do so in the future. Conformance with the standard is to be ascertained through use of currently accepted dose models, not microdosimetry on actual individuals, which is, as the commenter states, an unrealistic objective.

COMMENT 95: Evaluation of the cost-effectiveness of the standard is not possible without specification of compliance models, because these models are as important as the actual value of the standard itself. (I-15)

RESPONSE: The Agency expects that conformance with the standards will be demonstrated using the most reasonable and, as required, realistic models available. However, we do not believe that the impact of these compliance models on the cost-effectiveness justifications for the standard will be significant.

COMMENT 96: EPA should publish the models required for compliance with the standard. (P-25,I-4,I-27)

RESPONSE: Implementation of the standard will require models expressly designed for use in assessing compliance. It would be clearly inappropriate for the Agency to specify these models in detail, since enforcement responsibilities, including the development of implementation procedures and models, reside in the NRC. The Agency's "compliance" activities with respect to models will consist principally of review of the environmental transport models that NRC uses in order to assess their adequacy. Models intended for use for implementation have recently been published by the NRC for reactors (16,22). In addition, models are available for other types of facilities (23). These models are, in general, acceptable to the Agency for implementation. The NRC appears to be committed to the use of realistic models and recognizes the need for periodic revision of models as new information becomes available.

Regulatory Guide 1.109 (22) and the series of documents on "as low as practicable" control technology recently developed by ORNL (23) both utilize computer codes that use the dosimetric criteria of the International Commission on Radiological Protection (ICRP) and other recognized authorities. Although these codes generally implement models of internal radiation dose to man set forth in 1959 by the ICRP "Report of Committee II" (ICRP II), both codes have undergone modifications over the years to incorporate more recent data, particularly with respect to radionuclide decay schemes, and to add radionuclides. In addition, Regulatory Guide 1.109 also provides age-dependent dose conversion factors.

The Agency agrees, in principle, with this approach to the calculation of dose conversion factors. However, much of ICRP II is now out of date and requires revision. The Agency believes that ICRP II should not be used to calculate dose conversion factors for the purpose of implementation of these or any other standards without continuing review of the various biological and physical parameters to ensure that they reflect critical review of the most up-to-date information available. The Agency further believes that dose conversion factors should be calculated as a function of age when there is sufficient reason to do so. Radioiodine dose calculations are the most obvious example.

COMMENT 97: The mechanics of dose apportionment or allocation should be addressed as well as the associated issue of population definition. (I-6,I-7,I-10,I-15,I-17,I-19,I-20, I-21,I-22,I-25,S-20,F-1,F-5)

RESPONSE: Since the standard sets no direct limits on population dose, there is no requirement for definition of populations. Verification of compliance with the individual dose limits will require identification of critical receptors at each site, as is already required by NRC Regulatory Guide 4.8 (24). Dose allocation is not generally required. In those rare cases where a critical receptor may receive a significant (>5%) contribution of dose from a secondary source, it will be necessary to adjust technical specifications for each site slightly downward to allow for this eventuality.

COMMENT 98: The standard should specify whether the release quantities for Kr-85, I-129, and transuranics refer to all spent fuel or only that which results from electrical power generation after January 1, 1983. (F-4,F-6)

RESPONSE: The quantity limits (40CFR190.10(b)) apply to radioactive materials generated as a result of electrical power production after the effective date.

COMMENT 99: EPA should present a means for allocating Kr-85, I-129, and transuranic releases among various fuel cycle facilities. An accounting system should be developed that would show if it is practical to set a standard on the basis of electrical power generation and on what basis allowable releases can be calculated. (I-1,I-2,I-4,I-7,I-9,I-10,I-15, I-17,I-22,I-25,I-26,F-4,F-5)

RESPONSE: The requested analysis has been performed, and is referenced in Section VIII-A of the final statement.

COMMENT 100: It is not clear whether the standard applies to the "fencepost" or to the nearest real receptor. (I-15)

RESPONSE: The standard applies to real receptors. If, for purposes of simplifying compliance assessments, it is more convenient to use more conservative assumptions (such as "fencepost" receptors), this is acceptable.

COMMENT 101: The more conservative and more readily determined approach of applying the standards to a hypothetical person at the site boundary is a more practicable approach to implementation. (S-15)

RESPONSE: The standard applies to real individuals, so that in cases where no doses can be delivered unreasonable control requirements are avoided. This does not preclude any licensee from adopting, if it is more convenient, the more conservative approach of designing compliance in terms of hypothetical individuals at the site boundary.

COMMENT 102: EPA should incorporate into its standard an official statement that compliance with Appendix I provides satisfactory implementation of the standard. (I-8,I-13,I-20, I-26)

RESPONSE: It would not be appropriate to directly incorporate another agency's regulation into EPA's standard. However, the Agency has clearly stated its judgment on this matter and anticipates that NRC will design its regulatory implementation in a realistic manner so that, in all but the most extreme situations, conformance with Appendix I can be used to demonstrate compliance with these standards for up to 5 reactors on a single site. (See Comments 87, 92, 97, 106, 111, 112, 113, 114, 117, and 118, for related matters.)

COMMENT 103: The standards are vague and too easily permit variances for deviations from numerical standards. (P-1, P-24,P-25,S-2,S-11)

RESPONSE: The wording of the variance is deliberately broad in order to provide the implementing agency-wide flexibility in its use. However, the standards require full reporting of the nature and basis of each variance granted, as well as the schedule for achieving compliance. The Agency will review these reports to insure that unnecessary use of the variance provision does not occur.

COMMENT 104: EPA should establish procedures for EPA review of the granting of each variance and provide guidelines for use of the regulatory agencies. (P-25)

RESPONSE: Implementation of these standards is the responsibility of NRC, not EPA. The Agency will review guidelines established by NRC for the granting of variance, and will also review reports of variances granted.

COMMENT 105: Variances should be permitted only for electrical generating stations and not for other fuel cycle facilities, since the closing of other fuel cycle facilities for short periods would not influence the "orderly delivery of electrical power." (P-25)

RESPONSE: Orderly delivery of electrical power could be affected by fuel cycle facilities other than power reactors under some circumstances. It is not intended that justification for use of the variance be limited to emergency situations. The variance provision has been expanded to clarify the Agency's intent that the variance be available to any facility which is committed to an approved program to achieve compliance capability when this is judged to be in the public interest. If prompt, good-faith corrective actions are taken and the level of emissions is not extreme, shut-down would not normally be the regulatory course of action which is in the public interest. However, use of the variance provision is also predicated upon a showing that the condition causing the violation is temporary and unusual (i.e., not a normal performance expectation).

COMMENT 106: The variance mechanism should work retrospectively, as well as prospectively. (I-7)

RESPONSE: The Agency agrees that it may be appropriate to establish procedures for emergency use of variances without prior determinations under specified conditions, and encourages NRC to consider the feasibility of establishing such regulations.

COMMENT 107: It is not possible to accurately measure the potential exposure of any member of the public at the low dose levels of the standard. This is complicated by the fact that regulatory controls imposed on individual facilities will have to include a margin of safety to ensure compliance. The measurements could be very costly and even confused by other sources of radioactivity, such as hospital discharges. (I-1, I-15,I-16,I-22,S-20,F-5)

RESPONSE: Routine verification of compliance with the standards should be established using the existing system of effluent measurements related to doses to the public by use of NRC's environmental pathway models. Only in the case of possible noncompliance would additional supplementary measurements beyond site boundaries be appropriate. Measurements at the levels set by the standards are readily achievable using currently available environmental monitoring techniques.

Facility designers already include an operating margin in designing equipment to satisfy such regulatory criteria as those provided by Appendix I to 10CFR50; this standard would not require, in general, any additional margin. Other sources of radioactivity (such as the rare case of use of sewage treatment plant effluents, which contain hospital and laboratory derived radioactivity, as coolant water) are not expected to be significant at the level of the standard. If they were, independent measurements of the contribution should be made and attributed to that source.

COMMENT 108: EPA should determine the effect of the standard on site criteria. The low dose limits may make distance requirements dependent on normal releases rather then potential accidental releases. (F-4)

RESPONSE: The Agency believes that normal releases will not supercede potential accidents as the controlling basis for site distance requirements. In those few instances where current reactor designs (particularly regarding on-site gamma radiation sources) could make significant contributions at minimum-sized sites, inexpensive shielding modifications can remove this source of potential exposure or, as an alternative, the site can be enlarged in the critical direction.

COMMENT 109: Implementation should recognize that commercial nuclear fuel cycle facilities may provide services to national defense and foreign utilities. (I-4)

RESPONSE: Commercial fuel cycle facilities providing services to foreign utilities, or for defense-related activities have no special requirements known to the Agency that would make it unreasonable to meet the same environmental requirements that are appropriate for the domestic fuel cycle. However, if situations should arise in which a substantial fraction of a facility's operations are conducted for purposes not serving the commercial production of electric power, that portion of the facility's operation would not fall under these standards.

COMMENT 110: Backfitting of operating facilities may be required because of the standard. This should be discussed in the final statement and consideration should be given to exempting operating facilities for a period extending past the effective date. (I-15,F-1,F-6)

RESPONSE: No cases have been identified for which backfitting of power reactors will be required, beyond backfits required to satisfy existing regulations of the Nuclear Regulatory Commission (Appendix I to 10 CFR 50) and the possible need for additional shielding against direct and skyshine radiation at one reactor (Bailly). Among other fuel cycle facilities, significant backfitting of some mills may be required. It is anticipated that such backfitting can be reasonably accomplished within the three (four in the case of mills) years elapsing between promulgation of these standards and their effective dates. The milling industry has not indicated that it will be unable to comply within this period. Backfitting of one or two fuel reprocessing plants for krypton-85 and improved iodine-129 control may be required. However, the effective date for these isotopes, 1983, should provide ample time for the necessary planning and installation.

COMMENT 111: The standards appear to have been developed based upon the proposed Appendix I to 10 CFR 50, rather than the version finally promulgated. The implications of the changes between these two versions should be addressed, particularly with respect to deletion of quantity limits and per reactor limits in favor of per site limits by final Appendix I. (P-25,I-13,I-15,I-21,I-22,I-23,I-25,I-26,F-4,F-6)

RESPONSE: The standards, although they reflect the findings of the NRC regarding practicability of effluent controls for reactors, are not based upon Appendix I. It should be noted that the NRC, in promulgating Appendix I commented that, "If the design objectives and operating limits established in this decision should prove to be incompatible with any generally applicable standard hereafter established by EPA, these objectives and limits will be modified as necessary." The quantity limits contained in proposed Appendix I are of significance relative to these standards principally with respect to releases of the long-lived materials cobalt-60 and cesium-137. This matter is addressed by the response to Comment 112. The Agency has examined the issue of multiple reactors on a site (see Section VI-F) and concluded that Appendix I should, in general, provide a suitable design basis for assurance that these standards would be satisfied in normal operations for up to five reactor units on a site. Minor modifications in Appendix I would appear to be required to provide for review of extremely unusual siting situations and for cases involving more than five reactors on a site.

COMMENT 112: If the EPA standards are adopted as proposed, using quantity limits, the NRC will have to amend Appendix I because it is based on calculated doses. (I-6)

RESPONSE: The EPA quantity limits have no relation to the design and operating criteria of Appendix I for reactors. They apply to long-lived radionuclides, which are released in only minute quantities from reactors. If, in the future, EPA quantity limits were established for long-lived radionuclides emitted from reactors, such as tritium or carbon-14, revision of Appendix I may be required to incorporate these additional requirements.

COMMENT 113: EPA does not provide an adequate model of multi-unit sites or nuclear parks. In particular, sites whose units satisfy the requirements of Appendix I may well exceed EPA's standard with as few as three reactors per site. The model by which a multi-unit site can demonstrate compliance is not provided. (I-25, F-4)

RESPONSE: These issues have been discussed in Sections VI-F and VIII-A of this statement. It is concluded that sites with multiple units can demonstrate compliance using the same models as are used for single units. (See, also, Comment 114.)

The Agency did not use its own independently developed models in its consideration of sites containing more than two reactors, but relied on examples provided by the NRC.

COMMENT 114: EPA's analysis of multiple reactors on a single site was based on the proposed Appendix I to 10 CFR 50. Under the requirements of final Appendix I the standard of 25 mrem is impractical for a site with more than two or three large units, particularly in the case of boiling water reactors. (I-1, I-5,I-6,I-7,I-10,I-11,I-13,I-17,I-19,I-20, I-21,I-22,I-23, I-25,I-26,F-4)

RESPONSE: Several hypothetical cases have been developed which purport to show that the standards will limit the number of large boiling water reactors on a single site to two or three. Each case is predicated on one or more of the following assumptions:

(1) Appendix I dose limits for liquid and gaseous pathways will be typical rather than limiting for each unit's operation, these limiting doses from different units will occur simultaneously at the same location, and this location will be occupied by a single individual 100% of the time.

(2) Minimum site boundary distances for multi-unit sites will be the same as those for single unit sites.

It is true that any number of hypothetical siting and operating arrangements can be postulated which result in these standards limiting the number of units on a site. It is also true that in order to do this one must ignore previous siting practices and use unrealistic assumptions.

In order to assess siting practices for multiple units, we have examined the combined effects of turbine shine, gaseous effluents and liquid effluents for sites with two, three, and four BWR units with capacities that are greater than 1000 MW(e). All those sites were included for which doses from boiling water reactors have been assessed to date in final environmental statements; this includes seven 2-unit sites, one 3-unit site, and two 4-unit sites. The table below gives average doses for these multiple unit sites.

Direct radiation doses for 2- and 3-unit sites are those that would be experienced at the site boundary, for the 4-unit cases the dose is a 500-hour occupancy dose on the river bank (these model differences are a result of differences in the NRC models). The air submersion dose is the whole body dose at the nearest residence for the 2- and 4-unit sites and at the site boundary for the 3-unit case (nearest residence doses are not given). The pathway yielding maximum dose due to liquid effluents was used for the liquid pathway, and was generally fish ingestion:

No. Units Per Site	Direct Radiation Dose*	Direct Radiation Distance**	Air Submersion Dose*	Air Submersion Distance**	Liquid Pathway*	Total All Sources*
2	2.7	905	.85	1913	.86	4.4
3	0.6	--	1.6	--	< .01	2.2
4	.02	1055	.29	2287	.45	.76

*mrem/yr
**meters

The trend for maximum doses for the unit exhibiting the highest doses in each of the three categories is the same as that shown in the Table for average dose. The worst two unit case has a total dose from all sources of 9.9 mrem/yr compared to 1.1 mrem/yr for the worst 4 unit case. It should be noted that doses from these three pathways will not actually occur at the same locations; therefore, the totals given are overestimates of doses that would be expected to occur to real individuals.

Based on analyses of actual sites such as these, it is difficult to give credence to hypothetical worst case scenarios, and the Agency believes that current siting criteria of the NRC and industry practice will preclude any problems in meeting these standards for several boiling water reactor units on single sites. For sites with more than four reactors, the site size will probably increase and/or the site layout of the additional facilities may be varied so that the possibility of additive doses from multiple units will be even smaller. Sites with pressurized water reactors will have even less difficulty because direct radiation, as well as gaseous sources, are smaller than those from boiling water reactors. In view of current schedules for the construction of reactors (which show only 5 potential 4-unit sites, and no larger proposed agglomerations through 1985), if there proves to be a real problem there is ample time to consider it in the periodic review of these standards (at least every five years).

COMMENT 115: It will be impossible to implement the standards for uranium mills because of windblown particulate material emissions from uranium mill tailings piles. (I-3,S-15,F-4)

RESPONSE: Temporary (or, if the mill operator so elects, permanent) stabilization methods for active tailings piles are available that would be adequate to demonstrate compliance with the standards at mills (see, also, Comment 63). Offsite contamination that predates the standard is not retroactively covered by the standard.

COMMENT 116: EPA should consider the impact of the standard if the 25 mrem/yr limit is applied to surface radiation levels of shipping containers. The proposed use of nonstop shipment of spent fuel is incompatible with State and Department of Transportation regulations. (I-18)

RESPONSE: It is not necessary to require the modification of existing packaging and shielding requirements to satisfy the levels specified by the standards. Simply providing locations to which public access is restricted during layover periods for shipments of high-level materials, such as spent fuels, would be sufficient to insure doses below the level of the standards. Of course densely populated areas along the route should be avoided. With such precautions there should be very little chance that a person could receive a dose in excess of the standard. While it is true that there are State and local regulations which restrict the movement of radioactive shipments at certain times, careful scheduling and routing can usually overcome this problem and make nonstop shipments possible; this practice should be encouraged whenever feasible. However, if this is not possible, measures could be taken to prevent public exposure during layovers. For reasons not related to the above considerations, however, transportation has been deleted as an operation covered by these standards.

COMMENT 117: Selection of equipment to meet design objectives during the licensing process is always based on the higher SAR source terms. Thus, the implementative effect of the EPA limits must be judged based on SAR values, not environmental impact statement values. (I-25)

RESPONSE: Engineering judgments concerning the degree of conservatism appropriate to meet design objectives have been taken into account by NRC in establishing the design objectives of Appendix I, which are, in turn, judged adequate for implementation of the standard for current siting practices. It is concluded, therefore, that the impact of the EPA standard for light-water-cooled reactors will be essentially identical to that of Appendix I.

COMMENT 118: For any facility, an important aspect of implementation is the assumption made with regard to potential future occupancy locations by humans. The standard may require expensive retrofits if incorrect assumptions are made. (I-15,F-6)

RESPONSE: This will always be the case. This situation currently holds for the design of facilities to meet 10CFR20 standards and 10CFR50 guidance. It is not anticipated that the standard would introduce any burden in this regard that differs in kind from that imposed, for example, by Appendix I to 10CFR50.

COMMENT 119: Enforcement of the standard will be extremely difficult in the case of fuel cycle operations in close proximity to each other and for the transportation of nuclear materials. (I-5,I-19,I-23,I-18,S-2,F-4)

RESPONSE: The Agency is aware of no case in which the close proximity of sites would make implementation of the standard difficult. (See, also, Comment 97.) The Agency, also, believes that measures can and should be taken to provide reasonable assurance that transportation-related doses will not exceed 25 mrem/yr under any reasonably postulable situation. (See, however, Comment 116.)

COMMENT 120: The standard does not define "normal" operations, as opposed to "abnormal" operations. Such a distinction is essential for application of the limits to real situations. (P-19,P-25)

RESPONSE: The NRC in Regulatory Guide 1.21 "Measuring, Evaluating and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants" defines an abnormal release as an unplanned or uncontrolled release of radioactive material from the site boundary. Any such releases are reported separately from planned and controlled releases.

COMMENT 121: According to NRC models, the Barnwell Nuclear Fuel Plant will not be able to meet the standard with respect to maximum iodine thyroid dose rate within two years after promulgation of the standards. (F-4)

RESPONSE: The Agency considers NRC source assumptions for this facility regarding I-131 to be unreasonably conservative for operations during the foreseeable future. For example, it is assumed that all fuel will be processed at 160 days cooling. Because of the projected backlog of spent fuel waiting to be processed, it is reasonable to expect that all fuel processed in the foreseeable future will have been cooled longer than two years. The thyroid dose from I-131 will not be significant under those conditions. The Agency expects the Barnwell facility to be able to comply with the standard.

The NRC has indicated in testimony that fuel reprocessing plants designed and licensed after 1980 will be able to comply with the standard, presumably under the conservative assumption that 160 day cooled fuel will be reprocessed at that time.

COMMENT 122: The timing of the implementation of control of krypton-85 is questioned as being either too soon or too late. These comments reflect varying assessments of the need for control of krypton-85 in the next decade and of the availability of controls by 1983. (P-13,P-16,P-18,I-9,I-13, I-17,I-19,I-22,F-3,F-6)

RESPONSE: The choice of 1983 as the date of implementation for the control of krypton-85 was made both to allow time for the final development of treatment systems presently in a very advanced state of design and to provide control of these releases before any substantial potential health impacts could occur. It should be noted that the Brunswick boiling water reactor is using or about to use a cryogenic distillation system to minimize condenser air ejector noble gas releases. This system uses the same technology that could be applied to a fuel reprocessing plant. The Japanese are also installing a cryogenic distillation system on the Tokai-Mura fuel reprocessing plant, which is presently undergoing cold testing, and thus considerable operating experience should be available prior to 1983. While it is probably true that it is technically possible to install and use krypton control technology before 1983, the Agency does not believe that a more accelerated schedule is desirable or justified, in view of the small amount of reprocessing that will occur before that date, and the present lack of operating experience with krypton controls.

COMMENT 123: States conduct environmental radiation surveys outside the boundaries of nuclear power plants. It is likely that new measuring procedures not presently available to the States will be necessary to ensure compliance with the standard. It is recommended that the EPA provide the States with detailed procedures and necessary laboratory control procedures to ensure verification measurements. (S-12)

RESPONSE: Although the responsibility for implementation rests with NRC, the Agency will continue to provide assistance to the States, to the best of its ability, regarding quality assurance and new methodology for environmental measurements of radioactivity.

3. Impact on Energy Supply

COMMENT 124: The final statement should discuss the impacts on site development for multi-reactor sites and nuclear energy centers. Site developers must know the impact of the standard upon siting because these decisions are made many years prior to actual power plant operation. (P-14,I-6,I-13,I-17,I-19)

RESPONSE: The relationship of multi-reactor sites and nuclear energy centers to the standards is discussed in Section VI-F. Although it is possible that the standard could influence the selection and utilization of sites, it is far more likely that other factors, such as thermal and safety requirements, will be determining. Review of past siting practice shows that multi-unit sites have been selected in such a manner as to provide large enough sites that current levels of control technology can readily maintain doses to the public within the levels required by the standards, and the Agency expects that these practices will continue. Thus, the standards are expected to increase awareness of public radiation dose in site selection, but to not materially alter current practices. (See, also, Comments 113 and 114.)

Nuclear energy center site selection and planning is still in preliminary stages. Evidence from the recent NRC report "Nuclear Energy Center Site Survey" (NUREG-0001) indicates that other factors, such as thermal dissipation, will be limiting on site utilization and that radiation doses can be maintained within the standards for up to 20-40 units on a site.

COMMENT 125: The final statement should include a discussion of the possible influence of the standards on the mix of BWR's, PWR's, and HTGR's. (S-15)

RESPONSE: PWR's and BWR's equipped with radioactive waste treatment systems typical of currently designed plants will conform to the EPA standards, and HTGR's are generally expected to have lower environmental impacts than light-water-cooled reactors. HTGR's operate on the thorium fuel cycle and therefore are not included in the present standard. EPA has studies underway to assess the thorium fuel cycle with the goal of establishing standards. Since light-water reactors of both types equipped with control technology at the level required to satisfy the standards have been purchased by utilities, EPA sees no reason to believe that the standards will have any influence on the mix of these three reactor types.

F. ALTERNATIVES

COMMENT 126: The economic resources required to satisfy these standards could be more effectively spent to reduce health impact in areas other than nuclear power. The standards should be developed with such consideration of other activities. Such consideration would be in accordance with the recommendation of the BEIR report that "...there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise, would clearly produce greater benefit." (P-10,P-12,P-16,P-22,I-4,I-5,I-19,I-20,I-25,I-26, F-2,F-4)

RESPONSE: It will probably always be true that, for any given social expenditure, an alternative choice can be found that would yield a greater return. However, it will usually also be found that the resources involved are not transferrable. In any case, the possibility that greener fields may exist elsewhere for health effects reduction does not absolve the Agency from ensuring that appropriate measures be taken by the uranium fuel cycle. In no case does the Agency believe that the costs that would be incurred to satisfy these standards represent an unreasonable use of the Nation's resources.

COMMENT 127: The standards can be viewed as a determination of "as low as practicable" radiation levels for the entire uranium fuel cycle. As such, either Appendix I and similar future findings by the NRC, or these standards are redundant and therefore unnecessary. (I-16,I-24,I-27, F-4,F-5)

RESPONSE: Although the standards reflect existing findings regarding "as low as practicable" design levels for effluent controls for fuel cycle facilities, such findings are not a substitute for standards. For example, Appendix I provides guidance on the design objectives appropriate for light-water-cooled power reactors, but it provides no numerical limits on exposure of members of the public from reactor sites. In addition, the NRC is considering suspending pursuing such findings for other types of fuel cycle facilities. The Agency believes, however, that future findings concerning design objectives for fuel cycle facilities by NRC would provide extremely useful guidance to the industry on the design of controls appropriate for the implementation of these standards.

COMMENT 128: The final statement should consider the alternative of control via an emissions tax. (S-15)

RESPONSE: The Agency does not have legislative authority to provide radiation protection through this mechanism, nor does any other agency, under existing law. The alternative is, therefore, not realistically available.

G. MISCELLANEOUS

COMMENT 129: The statement on page 39 of the Draft Environmental Statement that "There are no other types of facilities in the fuel cycle which produce whole body doses of significance in comparison to these types of facilities" is incorrect. Doses from tailings piles or use of abandoned mine overburdens can cause exposures greater than those from the facilities listed. (S-18)

RESPONSE: The comment is correct, and this statement has been revised in the final statement.

COMMENT 130: The cost of electricity (30 mils/kwh) used in Figure 12 of the draft statement is very high, according to recent AIF figures. The figure should be corrected. (S-15)

RESPONSE: The use of mils/kwh is illustrative and does not enter the cost-effectiveness determination. The value used was based on the typical final cost to the consumer and is correct. The AIF survey showed the cost of generation to be approximately 9 to 12 mils/kwh, but this value does not include distribution and other costs to the consumer.

COMMENT 131: The final statement should give more attention to deep well disposal of tritium. (I-4,S-15)

RESPONSE: Tritium is not a subject of the standard. The Agency will consider deep well disposal in evaluations of alternative waste disposal techniques and in any future standard-setting considerations for this radionuclide. Deep-well injection would only be recommended if it is demonstrated to be an environmentally acceptable method of disposal.

COMMENT 132: The NRC has estimated that implementation of the standard will cost about $100 million. Such a major regulatory proposal as 40 CFR 190 is required by Executive Order 11821 to be accompanied by an inflationary impact statement. (I-4)

RESPONSE: Inflationary impact statements are required for Agency regulatory proposals under Executive Order 11821 only if the additional national annualized costs of compliance within any calendar year by the attainment date, or within five years of implementation, will total $100 million. Even if the Agency concurred in the NRC estimate, which it does not, that estimate is of the total cost through the year 2000, the annualized costs are clearly much less, and thus an inflationary impact statement is not required.

COMMENT 133: The basis for the 1983 implementation date should be given in the environmental statement. (I-6,I-25,F-6)

RESPONSE: This date was based on the Agency's judgment that it would provide adequate time for installation of the required control equipment, and that an earlier date was not required to satisfy public health protection requirements. (See, also, Section VIII-B.)

COMMENT 134: The draft statement does not properly qualify health risks, and represents the health impact as absolute, rather than providing proper qualification. (P-14,I-5,I-15, F-6)

RESPONSE: The Agency has issued a policy statement on the dose-effect relationship (Appendix B to Volume I), which provides the appropriate qualification of estimates of health risk, as did the supporting documents (2-5); and the draft statement consistently refers to "potential" health impact, in order to emphasize the uncertainty associated with any projection of health impact due to exposure to radiation.

COMMENT 135: EPA should not assess the health hazards associated with environmental radiation, since this could be carried out more appropriately by a national or international forum such as the NCRP and ICRP, respectively. (P-12,P-14, P-22,I-11)

RESPONSE: Reorganization Plan No. 3 of 1970 transferred to EPA the responsibility of the former Federal Radiation Council for advising the President on all radiation matters affecting health. In order to carry out this responsibility the FRC requested a complete review and report on health effects due to low level radiation from the National Academy of Sciences in 1970. EPA received this report in 1972. This information, which included specific estimates of health risks, was used, in conjunction with any more recent data that was pertinent in making the judgments required for these standards. In carrying out its statutory responsibility the Agency also maintains cognizance of the reports and deliberations of the NCRP and the ICRP. However, to date these groups have not provided specific estimates of levels of risk that can be usefully applied to the derivation of numerical standards for specific sources, such as these standards for the uranium fuel cycle.

COMMENT 136: It is reasonable to consider the existing Federal Radiation Protection Guides as adequate for the use of the nuclear industry. (F-5)

RESPONSE: Since the bioeffects of radiation are assumed to exhibit a linear nonthreshold dose-effect relationship, it is appropriate to reduce the number of potential health hazards from radiation whenever costs of control justify the reduction in health risks. Operation of nuclear facilities so as to deliver doses to members of the public of the order of 500 mrem/yr is completely unjustified, given a proper consideration of the feasibility and costs of reducing doses to small fractions of this level.

COMMENT 137: EPA should provide comparative risk estimates in order to place the impact of nuclear power on public health in perspective. Included in such a comparison should be natural background radiation, medical exposure, debris from weapons testing, and the risk from other fuel cycles such as coal or oil. (I-5,I-13,I-15,I-19,I-25,I-26,I-28,S-15,F-5)

RESPONSE: A comparative risk assessment would be appropriate if this environmental statement had as its objective an analysis of nuclear power, versus other methods of producing electrical power. It is not, however, the purpose of this statement to justify or make recommendations for or against nuclear power. It is, rather, the purpose of the statement to examine the alternatives and associated environmental impacts of standards to limit normal, or planned, releases of radioactive materials from the uranium fuel cycle. These alternatives and their associated environmental impacts are in no way affected by considerations such as natural background radiation, medical exposure, debris from weapons testing, or the risk from other fuel cycles, such as coal or oil.

COMMENT 138: EPA should attempt to obtain international agreements to capture krypton-85. (P-5,I-17,S-4,F-3,F-4)

RESPONSE: EPA fully supports the development of international agreements to capture krypton-85. It is therefore encouraging to see that the Japanese are going ahead with krypton control (cryogenic distillation) on their first fuel reprocessing facility,the Tokai-Mura plant, and that West Germany is actively considering control of krypton-85 in its first fuel reprocessing facility. It is hoped that, combined with the precedent established by these standards, these actions will constitute a major step towards international cooperation in controlling krypton-85 releases from fuel reprocessing plants. It is also of interest that the IAEA is currently in the process of developing guidance on the procedures for establishing limits for the release of radioactive material into the environment, which includes consideration of the worldwide impact of krypton-85, as well as other long-lived international pollutants, such as tritium and carbon-14. The Agency is actively participating in the development of this guidance.

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APPENDIX

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June 24, 1975

Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Re: Proposed 40CFR Part 190

To the Director:

INTRODUCTION

The proposed standards, 40 CFR Part 190, represent a vast improvement over 10 CFR Part 20. Limits, comparable to Appendix I for reactors, would be set for other components of the nuclear fuel cycle, and limits on the build-up of certain harmful long-lived radionuclides would also be set for all the components of the nuclear fuel cycle. The Environmental Protection Agency should be commended for this forthright action in the public interest.

This having been said, we believe that the EPA has made certain compromises in these proposed standards. Protecting the public health is not done in a political vacuum. Other agencies, more inclined toward the nuclear industry, and the nuclear industry itself, will be very critical of the proposed standards. In compromising, the EPA should bear in mind that the public has lost confidence in these industries and their supporting agencies, and has begun to place more trust in the EPA. If the EPA is not faithful to its responsibility of protecting the public health and the environment, then the public will more and more place their confidence in itself and the courts.

This critique of the proposed standards will point out that the EPA has not gone far enough, that certain compromises

have been made which are not in the public interest. We will deal primarily with the proposed standards, as they apply to fuel reprocessing plants, except for a discussion of the tailings piles at uranium mills.

We will point out that the EPA, by delaying proposed standars for mill tailings piles, has ignored one of the major contributors to potential health effects in the uranium fuel cycle. Next, we will show that the 100 year cut-off is arbitrary, and has the effect of grossly underestimating the potential health effects due to the uranium fuel cycle. Finally, we will show that the variance for unusual operations may allow the industry to continue polluting the environment for some time.

ONE HUNDRED YEAR CUT-OFF

The EPA has chosen to consider the potential health effects of radioactive materials during the first 100 years following their introduction to the environment. The EPA has limited itself to this hundred year period, "because of our inadequate understanding of their long term behavior (p.74)." This 100 year cut-off severely underestimates the potential health effects of certain radionuclides, and imbalances the risk reduction vs. cost analysis of Fig.3 (p.37).

Uranium Mill Tailings.

The EPA has previously calculated the health effects due to uranium mill tailings (EPA-520/9-73-003-D, "Environmental Analysis of the Uranium Fuel Cycle", Oct.,73). A model uranium mill services 5.3 model reactors for 30 years. The health effects from the uranium mill tailings pile for these 30 x 5.3 = 159 reactor years number 200 throughout the Northern Hemisphere, not including the potential health effects in the immediate vicinity of the uranium mill. In arriving at the figure, 200 health effects, the EPA has assumed a 100 year cut-off period.

The 100 year cut-off is not justifiable in this case because there is an adequate understanding of the long-term behavior of the emissions from the tailings pile, as well documented in the above quoted EPA reference. Uranium ore initially resides at depths 100 to 450 feet below the surface of the earth. In general, these ores are uncovered in strip mining operations. The residue from this uranium ore, after the uranium is leached from the ore, are called tailings. These tailings are left, behind dams and allowed to dry at the surface of the earth. The principal component of the tailings, thorium-230, decays to radium-226, which subsequently decays to radon-222. This radon-222 is an inert gas, and escapes the pile. Since thorium-230 has a half-life of 80,000 years, the tailings pile will radiate radon-222 indefinitely.

If a projection as to health effects can be estimated for 100 years, it can be estimated for future times as well; it is well-known how an inert gas will emanate from the tailings pile and distribute itself in the atmosphere. If one underestimates the health effects by assuming an 80,000 year cut-off, the half-life of thorium-230, the health effects due to this tailings pile increase to 800 x 200 = 160,000, or about 1,000 health effects per reactor year. If one follows the EPA's advice

and follows radionuclide effluents, "for as long a period as they may expose human populations (p.35)", the effects are greater yet.

The basis for these potential health effects may be rather easily established, and the control is straight-forward. The uranium ore has been brought to the surface where the thorium-230 decays to radon-222 in which form it can easily be released. When the natural uranium is buried 100 feet or more below the surface, the radon-222 can decay on its way to the surface; the emissions to the human environment are negligible. The obvious solution to the problem is to bury the tailings 100 feet or more below the surface. If one assumes potential health effects for 80,000 years, it would be cost-justifiable to bury the tailings pile to greater than a 20foot depth. However, assuming a 100 year cut-off, it becomes only marginally cost-justifiable to bury the tailings to a 2 foot depth.

The health effects from uranium mill tailings constitute one of the more serious health hazards of the uranium fuel cycle. The 100 year cut-off undersestimates the potential health effects and limits the remedial solution to rather ineffective means, namely, burial at a 2 foot depth. It is clear that burying the tailings to a 100 foot depth would raise the cost of uranium fuel enormously, but so be it. Intervenors have long argued that all the costs should be laid out so that comparisons between coal and uranium fuel cycles are honest.

The EPA, in the proposed standards, has exempted radon and its daughters, from consideration till some later time. This exemption cannot be justified; radon should be included.

Iodine.

Iodine-129 is in a highly mobile form at a reprocessing plant when the spent fuel is dissolved in nitric acid. The iodine is contained at a reprocessing plant with a DF = 10; thus 10% is released. These are projections for the Barnwell facility by the NRC; the figures for Nuclear Fuel Services are worse. It is known how iodine distributes itself in the environment. Of that 10% which is released at a reprocessing plant, the potential health effects for the half-life of 17 million years can be estimated. The one hundred year cut-off is arbitrary and should more properly be justified by the EPA. It is clear that a period of 17 million years would greatly increase the potential health effects, making the standards much more restrictive.

Of that iodine which is captured on silver zeolite beds, or in the intermediate level waste system of reprocessing plants, the EPA should follow the waste disposal aspects. Material with a half-life of 17 million years cannot be just buried and forgotten. The EPA has separated the waste disposal aspects of the fuel cycle from these standards, which ignores the 90% of the iodine produced. While we agree with the EPA that it is preferable to capture iodine than have it released, still the effects of waste disposal cannot be ignored for a radionuclide with a half-life of 17 million years.

It can be plainly admitted that if the EPA did consider the health effects for a period of time on the order of millions

of years, that no nuclear industry could contain the material with the confinement factor required. So be it. The EPA is compromising people's health with this arbitrary 100 year cut-off.

Plutonium.

A similar consideration applies for plutonium at reprocessing plants. The EPA assumes that any plutonium which becomes air borne will be captured on HEPA filters. It is assumed that these plutonium contaminated filters will then be buried at a Federal Repository. Then what? Because of the 24,000 year half-life of plutonium-239, this is not the end of the problem. By neglecting waste disposal aspects, and by assuming a 100 year cut-off, the EPA has limited itself to a small part of the plutonium problem.

HOW LONG IS "TEMPORARY"?

As part of the proposed standards, the EPA has proposed a variance for unusual operations, allowing the proposed standards to be exceeded if a "temporary and unusual operating condition exists and continued operation is necessary to protect the over-all societal interest with respect to the orderly delivery of electrical power". But how long is "temporary"? One year? One hundred years? The EPA has provided no guidance. This variance is a loophole for continued pollution.

One example will serve to illustrate the point. The EPA has maintained, for some time, that krypton-removal equipment is presently available; the NRC has argued the contrary. In the FES for the Midwest Fuel Recovery Plant, GE accepted three bids for kr-removal equipment. The availability date was 1977, five years following the FES. In the construction permit hearing for the Barnwell Nuclear Fuel Plant, September, 1974, the NRC claimed that kr-removal equipment would not be available for five years, or 1979, and further, that it was not cost-justifiable to install the equipment. There seems to be a pattern of delay here and it will be interesting to observe the attitude of the NRC, when and if the construction permit hearing for Nuclear Fuel Services takes place.

The EPA has granted the industry a leeway, by not imposing the proposed standards, which will require kr-removal equipment until January 1, 1983. However, the NRC could grant a variance for any number of reasons: the danger of handling krypton tanks, the unreliability of the equipment and the need for more development, radiation effects to workers, etc. Unless the EPA provides some guidelines and tightens this variance in some manner, the use of kr-removal equipment could be put off indefinitely.

THE PROPOSED STANDARDS ARE INEQUITABLE

The proposed standards are five times higher than Appendix I standards for reactors. The reason for this inequality can be traced to the method of analysis, namely, cost-benefit analysis. Because of the nature of reprocessing facilities and nuclear reactors, it is less costly to contain the radioactivity from reactors. Therefore, on a cost-benefit basis, it could be cost-justifiable to lower the whole body dose received near reactors to five mrems per year, while the maximum dose received near fuel reprocessing plants is 25 mrems per year. As a result, simply by living near a reprocessing plant, the residents are subject to greater risk than those near a reactor. Reprocessing residents are second class citizens.

We believe that this is essentially a poltical problem, and not an error by the EPA. Residents near a reprocessing facility, such as Barnwell, S.C. or West Valley, N.Y., enjoy less of the benefits of electrical generation, yet assume more of the burden. Whether these residents will allow this to occur remains to be seen. If not, then certain additional costs will be passed on to the utilities, and to the utility rate payers, or additional costs may be passed on to the reprocessing facilities which simply make them unprofitable. They may have to be operated by the Federal government.

Just because it costs certain parts of the nuclear industry more to control radioactivity is no reason for the local residents to suffer greater risk.

CONCLUSION

In general, we support this move by the EPA to limit maximum doses near other parts of the nuclear fuel cycle, and to limit the build-up of long-lived radionuclides in the environment. However, we believe that the EPA has not gone far enough in their proposed standards.

Dr. Marvin Resnikoff
Rachel Carson College
SUNY at Buffalo
Amherst, N.Y. 14261

July 3, 1975

Office of Radiation Programs
Environmental Protection Agency,
Washington, D.C. 20460

Dear Sirs:

I am writing you in regards to the proposed standards for radiation protection. I strongly suggest your new standards as they were published in the Federal Register, May 29. 1975; as "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle".

The use of a linear relationship between radiation exposure and biological activity rather than "safe" radiation levels would make radiation safety require-ments much more effective and safe for all mankind.

I appreciate your endeavors on behalf of a safe and clean environment.

Sincerely,
Mrs Robert Straczek

Sally Straczek
4618 NW McDaniel Rd
Portland, Or 97229

July 9, 1975
130 Endeavor Dr.
Corte Madera, Ca. 9492

Dear Director of Critical Studies,

I would like to affirm the proposed redudtion in radiation allowed by a factor of 20 times. This is a good step in the right direction. Tests on animals have demonstrated that there is no known safe dosage of Plutonium (Alpha Rays) that does not cause cancer.

I would like to see further reductions in radiation allowed until it approaches the natural radiation that is not man made.

Sincerely,

Larry Beans

University of Pittsburgh
SCHOOL OF MEDICINE
Department of Radiology

July 9, 1975

Director, Criteria and Standards Division
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Sir:

I hereby request permission to present testimony at the proposed rule-making hearings relating to the Environmental Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, to be scheduled by your agency at the end of the public comment period.

Specifically, my testimony will relate to the adequacy of the proposed radiation dose limits in the light of recent scientific data that the rate at which doses are received plays a major part in the evaluation of their health effects, along the lines of a recent scientific paper presented at the Eighth Midyear Topical Symposium on Population Exposure, October, 1974.

Sincerely yours,

Ernest J. Sternglass /dk

Ernest J. Sternglass, Ph.D.
Professor of Radiological Physics

eJs/dk

PRESBYTERIAN-UNIVERSITY HOSPITAL, PITTSBURGH, PA 15261 (412) 682-8100

NIAGARA UNIVERSITY
COLLEGE OF ARTS AND SCIENCES
NIAGARA UNIVERSITY, N. Y.

DEPARTMENT OF PHYSICS

July 11, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

RE: Comments on the Draft Environmental Statment - Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle.

Dear Sir:

I am in favor of the proposed standards, however, I believe two additional steps are necessary to accomplish the desired results.

First, an understanding should be reached with the Nuclear Regulatory Commission so that krypton-85 removal systems will be designed to release no more than 4000 curies per gigawatt year of krypton-85 and will be operated in a manner to achieve design performance. The proposed standard alone would allow the design and operation of systems with only minimum capabilities (50,000 curies of krypton-85 released per gigawatt-year) until 1988, when the standard would be reviewed.

Second, "The prevention of unlimited discharges of krypton-85 to the environment from fuel cycle operations is of high priority because of its potential for significant long-term public health impact over the entire world" (p. 130). The EPA should "advise the President with regard to radiation matters, directly or indirectly affecting health" (p. 16) that there is a need for an international treaty limiting the atmospheric discharge of radioactive gases and vapors with a radioactive half-life of over one year.

I would like to illustrate my point by means of an analogy. Suppose a village just outside a heavy industrial area such as Niagara Falls or Gary, Indiana adopted a very strict air pollution code to protect the health of its citizens. A very valid report, justifying the code, could be prepared to show how much the citizens would benefit by controlling the air pollution sources in the village. The report would be incomplete without a discussion of the quality of the incoming air and the potentially large benefits to the citizens if air pollution sources outside the village were also controlled. The fact that operations within the village did not further degrade the air they breathe remains as only partial solution to a public health problem.

Krypton-85 passes freely and easily across national boundaries as well as oceans and mountain barriers. Since krypton-85 is not labeled by country of origin, an analysis that considers only that portion of the krypton-85 produced in the U.S. is incomplete and lacking in perspective. I suggest that the section on Environmental Impact (p. 74-81 and figures 6,7,8) be revised to include projections of the global inventories of krypton-85, carbon-14 and tritium from all sources including fusion plants until the year 2025. There should also be a comparison between the uncontrolled global inventories and the global inventories if only the U.S. adopts containment policies. Estimates of the effect on the global inventory of a containment policy adopted by other individual countries or regions, on a country by country basis, would be very helpful. An examination of those comparisons would make the need for international cooperation apparent. The responsibility of the EPA to the american people seems to require the EPA to make some effort to secure a treaty limiting the krypton-85, tritium and carbon-14 concentrations in air coming into our country.

There are several specific areas where additional information would improve the accuracy or completeness of the draft statement.

A. The draft statement does not mention the quantity of krytpon-85 per gigawatt-year in an uncontrolled release. A private communication states 370,000 curies per gigawatt-year was the figure assumed for the statement.

B. The decontamination factor mentioned on p. 80 should be changed from 10 to 7.6.

C. It should be made clear that the model projections on p. 38 are significantly different from the proposed standard. The difference between 50,000 curies per gigawatt-year and 4000 curies per

gigawatt-year is large enough to question the validity of applying that model to the proposed standard.

D. The vertical axis in figure 8 should be given in terms of the global atmospheric inventory, since there is no distinction in properties or health effects produced between U.S. origin krypton-85 and krypton-85 from any other source. Figure 8 should indicate a range of concentrations as limited on one hand by a decontamination factor of 100 and on the other hand by a decontamination factor of 7.6 (the actual D.F. under the proposed standard).

E. Comments on containment of carbon-14 by a krypton containment system (eg. p. 38, p. 82, p. 84) should be modified to indicate that no such beneficial effect is expected from the selective absorption in flourocarbons type system favored by fuel reprocessing plant operators.

F. Projections of atmospheric krypton-85, carbon-14 and tritium should be compared to the atmospheric inventories of these isotopes of natural origin. The sum of the atmospheric ionization rates due to projected concentrations of krypton-85, carbon-14 and tritium should be compared to natural background ionization rate expressed in the same units, for typical land and sea stations. This last comparison will show that the ionization rate produced by the concentration of krypton-85, projected for 2025 will approach the natural background ionization rate at oceans stations. An inescapable conclusion is that natural phenomena related to atmospheric ionization will be affected as the ionization rate is increased by reactor by-products in the atmosphere. In my opinion, an environmental impact statement that focuses on radiobiological effects to the exclusion of other phenomena is incomplete.

NIAGARA UNIVERSITY
COLLEGE OF ARTS AND SCIENCES
NIAGARA UNIVERSITY, N. Y.

DEPARTMENT OF PHYSICS

The opinions expressed in this letter are my own. My employer, Niagara University, has made no official statement regarding atmospheric radioactivity or nuclear facilities.

I formally request an invitation to appear at the public hearing to be held on this subject.

Very truly yours,

William L Boeck

William L. Boeck, Ph.D.
Professor
Department of Physics
Niagara University

WLB/ca

P-5

PHOTOGRAPHY Architecture Landscape Commercial
Philip R. Levy
5161 NE Wistaria Dr.
Portland, Oregon 97213
(503) 287-3675

July 14, 1975

Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear People:

My wife and I are quite concerned about the various hazards involved in the nuclear industry, especially the as yet unknown effects of long term radiation exposure. Future generations deserve the most conservative evaluation of "permissible" radiation levels. As I understand it, your proposed standards for radiation protection (published May 29, 1975) assume a direct linear relationship between radiation exposure and biological functioning. Certainly this position seems very logical and understandable in light of much published concern about radiation exposure. And most importantly, your position will afford a greater level of protection for all life on the planet, now and for many, many years to come.

Thank you for your understanding.

Sincerely,

Philip + Denison Levy

Philip and Denison Levy

EUGENE FUTURE POWER COMMITTEE INC.

P.O. Box 5274 • Eugene, Oregon 97405

July 15, 1975

Director of Criteria and Standards (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, DC 20460

(Ref: Fed. Reg/
May 29, 1975
pp. 23420 ff.)

Dear Sir:

I am writing on behalf of the Eugene Future Power Committee and myself to support the new radiation protection standards (referenced above) proposed by the Environmental Protection Agency.

Composed of citizens in the Eugene, Oregon area, the Eugene Future Power Committee was organized in 1968 for the purpose of delaying construction of a nuclear power plant sponsored by their municipal utility, the Eugene Water and Electric Board. A four-year delay was implemented through initiative petition and a vote of the citizens of this city. The utility has benefited by the delay to determine that it is not advisable to proceed further with nuclear power, and they have turned to alternative energy source development.

The Eugene Future Power Committee has continued its interest in nuclear and other energy problems. Our studies of the nuclear power technology indicate that there are still many unanswered questions, an important one of which is the subject of EPA's revised protection standards.

The Eugene Future Power Committee endorses the proposed revised radiation standards and emphasizes the need for a careful study of the entire nuclear fuel cycle (from exploration and mine to final storage or disposal of fission-activation products). We feel that the long-term health impact on the total population is in need of further study and that conservative standards are desirable in the public interest pending more detailed knowledge of nuclear power technology.

We ask to be notified of public hearings on this matter. It is probable that one or more representatives of the Eugene Future Power Committee will wish to present testimony.

We appreciate the fine work done by the EPA in this and other areas of environmental vulnerability.

Sincerely yours,
R. G. Wolfe
R. G. Wolfe

(Professor of Chemistry,
University of Oregon)

for the Board of Directors
Eugene Future Power Commitee

RG:jn

July 14, 1975

Dear Sirs:

I commend your strict stand regarding "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle".

It is assuring to know you are able to do your job of "protecting our people & environment" when you are besieged by those with vested interests who are willing to take great risks for their lives & others & thereby have lesser standards.

I support your efforts with strengthening radiation safety requirements.

Sincerely,
Linda Cook
2570 SW Crestdale Dr.
Portland, Ore. 97225

18 JUL 1975

...Office
...Agency
22 JUL 1975

Gentlemen:

7/17/75

I strongly support your proposed "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle."

The University of Iowa

State Hygienic Laboratory

ENVIRONMENTAL SANITATION
MICROBIOLOGY
SEROLOGY
VIROLOGY

MEDICAL LABORATORY BUILDING • IOWA CITY, IOWA 52242
Telephone—Area 319: [illegible]

17 July 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

We offer the following comments on the proposed EPA Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle.

1. The vast majority of nuclear facilities already meet or exceed the proposed requirements.

2. The assumption throughout, for example lines 6-8 on p. 73 is that with more restrictive standards there will be (significant) positive public health results. We feel it can be argued that the effects will be nil or negligible. This proposal seems to be unscientifically based since an earlier standard is easily met and EPA proposes only to tighten it significantly since the economic impact at the moment is negligible, but with little evidence presented to warrant the change.

3. Over the long run, such requirements, in an energy-starved society, could prove extremely short-sighted. It would appear that it is appropriate to spend perhaps $\$5 \times 10^5$ to prevent one radiation-induced health effect, but it is surely much less cost effective than that, considering the conservative nature of the estimates made.

In a technological society, each of us is subjected to a variety of deleterious influences which we would prefer not to be subjected to: incompetent drivers, cigarette smoke from others, general air pollution, a variety of food additives, etc. Many of these are known to present a vastly greater hazard than the 34,000 "potential health effects" (p. 82, Table 10) predicted thru the end of this century if individuals at site boundaries were subjected to 170 mrem/year. To argue for a half million dollar expenditure to prevent one of these "health effects" seems unjustified. The money could certainly be spent in better ways to improve or protect public health.

4. Philosophically we disagree with what is being proposed. The studies of the Atomic Bomb Casualty Commission indicate that anticipated health effects in irradiated Japanese and their offspring were much smaller than anticipated - at doses of 90 rem and above - 3000x greater than what EPA proposes.

5. Considering the State of Iowa individually, it is our judgement that prognosticated future nuclear plant developments for power generation is environmentally compatible with not only the current standards, but could meet the proposed criteria if all available facilities and agencies for planning are utilized at appropriate technical and administrative levels and periods.

6. Since Iowa is a vital food production state instrumental to feeding the nation and the world, it is hoped long time storage or processing of radioactive wastes in our state would be discouraged. For the same reasons, we are most interested in seeing these materials transported to and from our power stations by adequate means. We are deeply interested in protection of the well being of our citizens, but our productive land and water so important to the whole world is an added responsibility.

In summation, while we feel the proposed tighter standards are academic and indefensible from a real cost-benefit standpoint, they can probably be met under current design conditions and those immediately ahead of us.

Rolf M. A. Hahne

Rolf M. A. Hahne, PhD
Assistant Director

R L Morris

Robert L Morris PhD
Associate Director

mrw

cc: Mr Larry Crane
Mr Elmer H Vermeer

CRITICAL MASS
THE CITIZENS MOVEMENT TO
STOP NUCLEAR POWER
P.O. Box 1538, Washington, D.C. 20013

July 23, 1975

Director, Criteria and Standards Division
Office of Radiation Programs
U.S. Environmental Protection Agency
401 M St. N.W.
Washington, D.C. 20460

The following are comments to the Draft Environmental Statement prepared by the Environmental Protection Agency on the ENVIRONMENTAL RADIATION PROTECTION REQUIREMENTS FOR NORMAL OPERATIONS OF ACTIVITIES IN THE URANIUM FUEL CYCLE:

1. On page 17 the EIS properly notes that "EPA is not limited to specific criteria for setting such standards." Yet the EPA is arbitrarily accepting such criteria when it notes on page 4 a projection that "well over 300,000 megawatts of nuclear electric generating capacity based on the use of uranium fuel will exist within the next twenty years." Throughout the text of the EIS, the acceptance of a given output of nuclear generated electricity forms the basis for determining what an "acceptable" level of population exposure to radioactive effluents should be.

EPA should not be an apologist for either the Administration or other federal agencies. The intent of EPA's enabling legislation was to establish an independent review and regulatory agency in matters of environmental concern. In order to determine what set of exposure standards should be established, EPA should explore what the level of emissions would be under a limited or zero nuclear growth and to determine if such a scenario were feasible. If it can be shown that a limited nuclear dependency were practicable, then the present standards of exposures could then be shown to be too high. EPA, therefore, might find that a standard of zero emissions might, in fact, be a "reasonable" standard.

There has been ample discussion of the potential of conservation to reduce the demand for electrical consumption and the availability of alternative sources to replace nuclear power. The Ford Foundation's study, A Time to Choose, found, for example, that with an annual energy growth rate of two percent, a major energy source such as coal or nuclear could be eliminated without detrimental economic effects. Similar conslusions were reached by the Public Interest Research Group's review of energy scenarios (available from PIRG, 2000 P St. N.W., Washington, D.C.) and the Rand Corporation study California's Electric Quandry.

These independent reviews suggest that credible estimates of the need for nuclear power, other than those offered by the Administration, exist. EPA's critique of the EIS of the Liquid Metal Fast Breeder

Reactor suggests that the agency is fully capable of examining electrical demand projections. EPA would be remiss, therefore, if it did not include a discussion of a zero emission level in the context of a limited nuclear scenario.

2) The standards proposed by EPA are based only on routine operation and ignore accidental releases. Yet the large amount of radioactivity from an unplanned release may be serious enough to warrant that no variances from the proposed standards be issued.

The former Atomic Energy Commission (AEC), in an effort to determine the probability and extent of a major accident from an operating nuclear reactor, funded a Reactor Satety Study (RSS, WASH-1400) which was issued in draft form last August. The RSS found that in the event of the worst possible accident, 2300 immediate fatalities would occur. EPA and theAEC Regulatory Staff independently concluded that there had been a factor of 10 underestimation in RSS. The Union of Concerned Scientists (UCS) and Sierra Club, in a separate study, identified a factor of 16 underassessment. These discussions, confirmed by a report issued by the American Physical Society in April, 1975, swell the potential number of fatalities from 2,300 to 23,000 to 36,000. This set of figures is for prompt fatalities and does not include lethal cancers or genetic defects and is still more than double EPA's estimate of total health effects given on page 82. If only one such accident were sustained, a possibility which is receiving increasing attention, the cost-benefit ratio developed for a given level of reactor operation would be completely rewritten.

The RSS considers one accident which is small compared to the large one above, but one with relatively large probability. Here, RSS predicts 62 prompt fatalities, 300 latent and ultimately fatal cancers and 300 genetic defects. Correction of RSS figures using AEC, EPA and the UCS/SC estimates of errors yields the following consequences:

Consequence	RSS Result	Corrected Result
prompt fatalities	62	620-990
lethal cancer	300	10,000-20,000
genetic defect	300	3,000-20,000

This scenario, because of its relatively high probability coupled with uncertainties of human failure, sabotage and poor quality control, could occur several times by the year 2000. If such consequences were to happen only once, this could result in total health effects four times higher than EPA projections for routine operation alone. Clearly, consequences of this magnitude should be figured into a benefit-cost analysis. If a negative ratio is found to develop, EPA should state that with its proposed standards, no variances would be granted and that unless a facility could offer reasonable assurances that it would not exceed such standards (i.e., no accidents), the Nuclear Regulatory Commission could not allow it to operate.

3) The waste disposal sites currently used, while serving primarily as storage sites for waste generated by the weapons program, contain sufficient uranium fuel cycle wastes that the EPA could choose to include them under the proposed standards. Further, significant unplanned releases have occurred such that EPA should again consider the inclusion of unplanned releases into its benefit-cost ratios and proposed standards.

4) A report released by Dr. John Gotman in May, 1975 suggests that the standard for transauranics may be too high. Dr. Gofman's estimates suggest that if the population exposure reaches the limit of .5 millrems per year, 7,000,000 extra fatal lung cancers can be expected to develop in male smokers per generation. For non-smokers the figure would be 60,000. Since these would occur over a 30-year period, it can be expected that 235,000 extra fatal cancers would develop per year in men (compared to the current lung cancer fatality rate of 63,500 from all causes). This data should certainly be examined and standards set according to revised benefit-cost ratios. (Dr. Gofman's report, "The Cancer Hazard from Inhaled Plutonium," may be obtained by writing to the Committee for Nuclear Responsibility, Box 2329, Dublin, CA 94566.)

5) Dr. Edward Martell, in a paper entitled "Tobacco Radioactivity and Cancer in Smokers," reprinted in American Scientist, July, 1975, suggests that it is alpha irradiation of lung cells brought about by the presence of ^{210}P, which is a likely cause of cancer and a contributing factor in the early development of artherosclerosis in smokers. His work provides a valuable guide to the possible consequences of chronic exposure to the inhalation of insoluable particles of moderate-to-low alpha activity and if properly considered, may significantly alter the benefit-cost ratios of EPA's proposed standards.

6) EPA's failure to include "genetically-related component of diseases such as heart diseases, ulcers, and cancer as well as more general increases in the level of ill-health from estimates of genetic effects" (p. 83) is irresponsible in view of developing solid evidence that low levels of radiation considered "safe" a few years ago are able to produce cumulative genetic degradation that can lead to leukemia and other diseases in future generations. See, for example, the paper by Bross and Natarajan in Preventive Medicine, Sept. 1974, pp. 361-369. Inclusion of this type of data on genetic effects may significantly alter EPA's benefit-cost ratios presented in support of its proposed standards.

In its review of the information available to it, EPA will find that much of the information on the effects of radiation is speculative. The advice offered by Ralph and Mildred Buchsbann in their book, Basic Ecology (Pittsburgh, 1957) is particularly appropriate: "When information is incomplete, changes should stay close to the natural processes which have in their favour the indisputable evidence of having supported life for a very long time."

Respectfully yours,

Skip Laitner

Skip Laitner
Coordinator, Critical Mass

CEI

Council on Energy Independence
P. O. Box 328
Chicago, Illinois 60690

July 23, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Comments of the Council on Energy Independence on the Environmental Protection Agency's proposed 40 CFR 190 are hereby forwarded for your consideration in accordance with the request for comments printed in the Federal Register, vol. 40, No. 104, page 23424 of May 29, 1975.

We appreciate this opportunity to make our views known.

Very truly yours,

Daniel C. Kasperski

Daniel C. Kasperski, Ph.D., P.E.
Director

DCK:dr
Enclosure
cc: The Honorable Mike McCormack (1/1)

COMMENTS ON PROPOSED 40 CFR PART 190

It is indeed unfortunate that the Environmental Protection Agency (EPA) has felt the need to modify the Federal Radiation Protection Guidelines for industries in the uranium fuel cycle. While we have no question as to the EPA's authority to do so as a result of Reorganization Plan No. 3, we question whether these proposed modification are in fact in the best interests of the country. If it is the EPA's intent to further reduce the man-rem dose to the general population, it would appear to be reasonable to begin this task with those sources of exposure which cause the greatest man-rem dose. In its own report(1), the EPA noted that the greatest source of radiation dose in the United States is from natural radiation. Though a number of studies have been performed, none has yet demonstrated deleterious effects on a human population living in natural radiation environments even considerably higher than those existing in the United States. Thus, the concept that low levels of low-LET (linear energy transfer) radiation exposure delivered at low dose rates is indeed dangerous must be questioned. Moreover, attempts to lower man-made dose commitments should be thoroughly justified with the benefits clearly demonstrable.

With respect to man-made radiation, the EPA, in the same report, stated that medical diagnostic radiology accounts for a full 90% of the total man-made radiation dose to which the United States population is exposed. This in turn accounts for only 35% of the total radiation dose from all sources, including natural radioactivity. Thus, by its own figures, the EPA admits that all other sources of man-made radiation taken together, including fallout from nuclear weapons, occupational radiation exposure, miscellaneous exposure to things like color television, consumer products, and air travel, and other peaceful uses of atomic energy (including the generation of electric power) accounts for less than 4% of the total man-rem dose. Furthermore, the total man-rem dose from the miscellaneous category above accounted for 50 times the man-rem dose from nuclear electric power production in 1970, again according to the EPA's own figures. The average per capita dose in the year 2000 from all nuclear power plants and fuel reprocessing plants expected to be constructed by that time has been estimated by the EPA to be 0.4 millirem per year, or about 4 tenths of one percent (0.4%) of natural background. This is well below the variation in natural background within the United States, which may vary by a factor of two or more (e.g., from 100 mrem/yr in Chicago to 200 mrem/yr in Denver). Thus the contribution to population exposure from nuclear facilities is truly negligible. A considerably greater man-rem dose reduction could be saved by the EPA proposing to ban the construction of brick and concrete structures and allow only wooden buildings, since the terrestrial dose rate from such building materials average 100, 70, and only 50 mrem/yr. Hence, it appears of little merit to change the Federal Radiation Protection Guidelines for this one industry, and yet take little action on reducing the major sources of man-rem exposure, if indeed it is even necessary, especially during these days of energy scarcity.

In spite of the small percentage of the total man-rem dose resulting from radioactive effluents of the uranium fuel cycle, the nuclear industry conforms to the "as low as practicable" (ALAP) philosophy. This concept was first proposed by the National Council on Radiation Protection and Measurements (NCRP)--a nonprofit corporation of renowned scientists chartered by Congress to formulate radiation protection recommendations--in a 1949 report (published in 1954 as NCRP Report 17)(2). Since then, this philosophy has been incorporated into the licensing requirements of all facilities licensed by the Nuclear Regulatory Commission (NRC), and design objectives for light-water-cooled nuclear power reactor effluents are contained in 10 CFR 50, Appendix I(3). The guidelines contained in Appendix I were arrived at only after many months of review and public hearings initiated in 1971 by the Atomic Energy Commission, the NRC's predecessor. Even though the present Appendix I limits for individual and population exposure are more restrictive than those proposed by the EPA, we oppose the EPA's proposal as there is a definite distinction between design objectives, as under the NRC's Appendix I, and new federal standards as proposed by the EPA. Dr. Lauriston S. Taylor (President of NCRP) must have foreseen the attempt by government agencies to further reduce the already low radiation protection limits for the nuclear industry. In a letter to Nuclear News (4), he pointed out that it must be "made abundantly clear that the reason for the proposed reduction (ALAP) is not a change in the basic radiation protection standards, but only because experience has shown that it is cheap and feasible to operate light-water-cooled nuclear power plants at very low levels." He continued, "it must, thus, be clear that the reasoning underlying the constant pressure to reduce dose limits is more of a political than a scientific nature." The prestigious International Commission on Radiological Protection (ICRP) agrees with Dr. Taylor and the NCRP, and has issued a statement indicating that on the basis of their recent and exhaustive examination of the question, they have decided that the present standards (essentially those contained in 10 CFR 20 (5)) not only do not have to be lowered, but could in fact be raised if there was any special reason to do so (6).

In its attempt to justify these proposed new limits as standards, the EPA quotes from the 1972 Report of the Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR Committee) of the National Academy of Sciences-National Research Council. The

quotes presented may leave the mistaken impression that the BEIR Committee recommends the lowering of present radiation protection limits. The BEIR Committee never made such a recommendation, however, and even admitted that "it is not within the scope of this Committee to propose numerical limits of radiation exposure"(7). (Furthermore, although these quotes were taken from the section on Summary and Recommendations, the point on Radiation Protection Guides quoted was never addressed in the body of the text, thus leaving the statement open to considerable interpretation and criticism.) In fact, it is the NCRP which has been chartered by Congress to "collect, analyze, develop, and disseminate in the public interest information and recommendations about (a) protection against radiation and (b) radiation measurements, quantities, and units, particularly those concerned with radiation protection"(8). In a recent report (NCRP 43) entitled "Review of the Current State of Radiation Protection Philosophy"(9), the NCRP thoroughly investigated all pertinent material on the biological effects of radiation, including the BEIR Committee report. In it, the Council takes the firm position that "no change is required at this time" in the present radiation protection standards. While continuing to support the ALAP philosophy, it differs with the BEIR Committee's estimate of somatic damage from low level exposure, and is in better agreement with the 1972 report of the United Nations Scientific Committee on the Effects of Atomic Energy (UNSCEAR) (10). The BEIR Committee Report differs from the UNSCEAR Report and the NCRP position in presenting numerical estimates of carcinogenic risk at radiation levels far below the observed data levels, and it errs in extrapolating "by a factor greater than 1,000 in dose and by factors from 100 million to a billion in dose rate, from the level of observed effects to the levels encountered by the general population"(9). The NCRP continues to hold the view that "radiogenic cancers at low doses and low dose rates derived on the basis of linear (proportional) extrapolation from the rising portions of the dose-incidence curves at high doses and high dose rates cannot provide realistic estimates of the actual risks from low level, low-LET radiations, and have such a high probability of overestimating the actual risk as to be of only marginal value, if any, for purpose of realistic risk-benefit evaluation." Hence, "such risk estimates by themselves do not constitute justification for urgent action to make numerical radiation protection standards more restrictive than they now are, assuming that the application of such standards adheres to the basic principle of 'lowest practicable levels' of dose".

Of the EPA's use of the man-rem concept for purposes of formulating standards such as the ones proposed, the NCRP says the following:

> "The linear dose-effect hypothesis has been coming into frequent use in analyses in which population exposures are expressed in the form of person-rem, including doses of one millirem per year or less to population groups and doses to individual organs, with linear extrapolation to damage estimates through the use of the NAS-BEIR Committee Report values. The indications of a significant dose rate influence on radiation effects would make completely inappropriate the current practice of summing of doses at all levels of dose and dose rate in the form of total person-rem for purposes of calculating risks to the population on the basis of extrapolation of risk estimates derived from data at high doses and dose rates." (9)

In perhaps its most strongly worded statement to date on the subject, the NCRP certainly appears to disagree with the implementation of the EPA's proposed standards:

> "The NCRP wishes to caution governmental policy-making agencies of the unreasonableness of interpreting or assuming 'upper limit' estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption. The NCRP has always endeavored to insure public awareness of the hazards of ionizing radiation, but it has been equally determined to insure that such hazards are not greatly overestimated. Undue concern, as well as carelessness with regard to radiation hazards, is considered detrimental to the public interest." (9)

Both the NCRP and the BEIR Committee agree on one point. With respect to performing benefit-risk analyses, the NCRP holds that it "is important to avoid the expenditures of large amounts of the limited resources of society to reduce very small risks still further with possible concomitant increase in risks of other hazards or consequent lack of attention to existing greater risks". (9) The BEIR Committee concurs in stating "there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise, would clearly produce greater benefit". In light of the previous comments by the NCRP with respect to performing estimates of somatic disease based on ultra-conservative assumptions, the EPA does everyone a disservice by its perfunctory risk analysis which predicts an expense of $100,000 per assumed cancer reduction if these proposed standards become effective.

Studies of radiation protection indicate that there are far greater economies in reducing public (environmental) exposure

from other sources than in reducing public exposure from nuclear power plants and fuel reprocessing facilities. Terrill (11), for instance, has presented a comparative cost-benefit analysis for radiation dose reduction from medical and from reactor-produced exposures. He indicates that then current (1971) doses to the U.S. population resulting from reactor plant effluents were 430 man-rem compared to 18.7 million man-rem from diagnostic x-rays. Yet, he found that costs per man-rem reduction were about $7.00 for medical exposure (from the use of automatic collimators on diagnostic x-ray equipment), compared to his estimated cost of $10,000 to 1 million dollars per man-rem for reducing reactor-produced radiation. How the EPA justifies their proposed regulations in the light of such data is uncertain.

In conclusion, as it has not been demonstrated that the man-rem doses to the population from the uranium fuel cycle are indeed harmful, beyond that which can be accepted in light of the benefits received and compared to the risks from other and alternate technologies, we feel that the proposed 40 CFR 190 is unnecessary and scientifically unsound, and should be rescinded.

(1) U. S. Environmental Protection Agency, "Estimates of Ionizing Radiation Dose in the United States, 1960-2000", USEPA, Rockville, Maryland, 1972.

(2) National Committee on Radiation Protection, "Permissible Dose from External Sources of Radiation, NCRP Report No. 17", published as National Bureau of Standards Handbook 59, U. S. Government Printing Office, 1954.

(3) Title 10, Code of Federal Regulations, Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as Practical' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents".

(4) Lauriston S. Taylor, President, National Council on Radiation Protection and Measurements, letter to Nuclear News, November 1973.

(5) Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation".

(6) Health Physics, Vol. 24, p. 360, 1973.

(7) Report of the Advisory Committee on the Biological Effects of Ionizing Radiation, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," National Academy of Sciences-National Research Council, November 1972, Washington, D.C.

(8) Charter of the National Council on Radiation Protection and Measurements, p. 39, NCRP 43, see reference 9.

(9) National Council on Radiation Protection and Measurements (NCRP) Report 43, "Review of the Current State of Radiation Protection Philosophy", January 15, 1975, Washington, D.C.

(10) United Nations Scientific Committee on the Effects of Atomic Radiation, "Ionizing Radiation, Levels and Effects", United Nations, New York, 1972.

(11) J. G. Terrill, Jr., paper presented at the American Public Health Association annual meeting, Chicago, Illinois (October 11, 1971).

10912 Nestle Ave.
Northridge, Ca. 91324
July 23, 1975

Re: Proposed Standards -
Radiation Protection for
Nuclear Power Operations

Director, Criteria and Standards Division (AW 560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Friend,

I was very hopeful that the new EPA radiation standards based on the concept of "environmental dose commitment" would be meaningful and improve the radiation protection situation. I am sadly disillusioned after having studied the EPA proposal.

You state, "The prevention of unlimited discharges of krypton 85 to the environment from the fuel cycle operation is of high priority because of its potential for significant long-term public health impact over the entire world", and then you delay standard setting until 1983! Some priority!

George Berg of the University of Rochester School of Medicine has written that "the naturally non-radioactive krypton in the atmosphere has already been so enriched with krypton 85 that people working with krypton gas have to be protected from exposure to radiation."

EPA has projected 6,900 health effects from krypton 85 (2/3 fatal) by 2020. (Environmental Radiation Dose Commitment: An Application to the Nuclear Power Industry). Is this acceptable to EPA?

Joseph Knox and Kendall Peterson stated in Nuclear Safety Vol. 13-2 p 130, "Although methods have been developed to retain at least part of the krypton 85, to date these techniques are costly and have not been used commercially."

Other scientists maintain that there is no known method of permanently containing gases -- they ultimately escape into the environment.

EPA is providing no protection to the public from krypton 85, iodine 129 and tritium. Why notsay so directly?

EPA is failing, as its predecessors failed, to protect the public from radon emissions. Many other dangerous isotopes are not even mentioned!

Section 190.10 "Standards for normal operations" and section 190.11 "Variance for unusual operations" are meaningless for these reasons:

1. There is no way to measure which radiation has entered the human

body or the food chain from "planned discharges" as opposed to "temporary and unusual operating conditions", or for that matter from fallout or other sources.

2. People living near nuclear plants are already eating food and drinking water which give them more than 25 millirems per year.

3. Variances can be granted to all the standards.

4. The standards for krypton 85 and iodine 129 are delayed until 1983 (and if they cannot be met by operating plants, then what?)

Any intelligent citizen reading these proposed standards must conclude that they were written by:

1. fools
2. the nuclear power industry
3. intimidated civil servants
4. ignoramuses

or5. those who do not care what happens to people

The cancer death rate is increasing by 1% a year. One of five deaths of those over 45 and under 14 is due to cancer or leukemia. Some of these deaths are from radiation. What increase in deaths is acceptable to EPA in exchange for nuclear power?

Sincerely,

Dorothy Boberg

HEALTH PHYSICS SOCIETY

COMMITTEE CORRESPONDENCE

J. M. Selby
Battelle-Northwest
P.O. Box 999
Richland, WA 99352

July 23, 1975

Director
Criteria & Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

The proposed Part 190 of 40 CFR, "Environmental Radiation Standards for Nuclear Power Operations" and the Draft Environmental Statement, "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle" have been reviewed by members of the State & Federal Legislation Committee of the Health Physics Society. We appreciate the opportunity to provide our comments.

Our comments are addressed primarily to the Draft Environmental Statement; however, generally it is our opinion that the issuance of Part 190 regulations is premature since the Environmental Statement from which these regulations stem is still in draft and problems associated with that draft have not been resolved. It appears that the Draft Statement is an excellent example of a government agency pretending to place reliance on the relationship between population dose and potential health effects as assumed in the BEIR Report[1], contrary to the recommendations of NCRP Report #43[2]. The following paragraph is taken from page 4 of that report.

> "The NCRP wishes to caution governmental policy-making agencies of the unreasonableness of interpreting or assuming "upper limit" estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption. The NCRP has always endeavored to insure public awareness of the hazards of ionizing radiation, but it has been equally determined to insure that such hazards are not greatly overestimated. Undue concern, as well as carelessness with regard to radiation hazards, is considered detrimental to the public interest."

The proposed action by the EPA is opposed to the position taken by the NCRP which recommends, particularly in regard to extrapolated cancer risk, that no change in radiation protection standards be made pending further review and evaluation of additional data that has become available since the 1972 UNSCEAR[3] and BEIR Committee Reports were published. It is of continuing concern to professional health physicists that the Environmental Protection Agency is proposing actions which are contrary to the evaluations and recommendations of independent and recognized authoritative entities in this field of science.

EPA generally presents the case as if adopting these standards will in fact, and without question, reduce total health effects through the year 2000, by 1000 as compared to what would occur based on present 10 CFR 50 Appendix I limits. Emphasis on the theoretical nature of that calculation is needed, especially since the statement published in the Federal Register[4] as a preface to the proposed 40 CFR 190, and included as Appendix to the Draft Statement states (p. 123):

> "However, the environmental models used for making these assessments, while useful for making estimates of potential health impact, are not considered to be so well-defined as to allow standards for populations to be expressed directly in terms requiring their explicit use."

Interestingly, if one makes a calculation using the argument EPA developed, one can conclude that NRC's 10 CFR 50 Appendix I Standards are resulting in the reduction of nearly 130,000 ($\sim$90%) of the potential health effects through the year 2000 as compared to what would occur based on present FRC guidance for the maximum individual. One might question whether the cost and effort to produce another 1,000 reduction makes sense at all, especially since no apparent attention is given to the relative impact of U. S. activities as part of a world-wide nuclear economy.

It should be noted that the EPA, prior to proposing a reduction in the radiation standard, estimated[5] the environmental radiation doses caused by the nuclear electric power production process to be less than 1% of the natural radiation dose by the year 2000. In this earlier report EPA estimated for the years 1960 to 2000 that the per capita dose to the population would actually decrease slightly. On the other hand for the same period it was estimated the annual whole body doses to the U. S. population from occupational exposure from industrial practice would increase by 2-1/2 times. The Draft Environmental Statement fails to evaluate the potential occupational dose impact of the proposed action in further increasing the concentration of radioactive materials in industrial practice; which from EPA reports, appears to be a significant source of population exposure.

Particularly disturbing and worthy of additional comment is the position EPA takes relative to ^{14}C. From the tables of potential health effects, it is clear that a case has been made for ^{14}C being the principal radionuclide of concern with current operating practices. For some reason, after developing this point, it

is not pursued and the position has been taken that ^{14}C control and retention can be addressed at a later date. The single most important contribution the Draft Impact Statement makes may be in presenting the long-term ^{14}C problem. If the data are correct and the presentation is representative of reality, then the Impact Statement has shown an area where the development of improved control systems can make a significant reduction in the theoretically calculated health effects.

The proposed five year delay before reviewing and amending the proposed standards seems to us to be completely untenable, not only because of the indicated ^{14}C problem, but also because of the potential impact on proposed nuclear energy centers. It may be true, as stated in the Draft Statement, that such centers are not apt to be in full operation for 10 years or more, but planning and decision-making are underway now. The Nuclear Regulatory Commission, for example, is required to submit a report to Congress in October 1975 on the comparative impacts of integrated vs. dispersed fuel cycle facilities. Any realistic evaluation of the impact of the proposed standards must take into consideration any effective limitations on the nuclear energy center concept.

Among a number of unsupported assumptions made, perhaps the most questionable is that implementation and enforcement of the proposed standards by the NRC will be easy and can be effectuated immediately. To the contrary, in our opinion the lack of precedent for allocating exposure to specific fuel cycle activities, much less individual facilities, and the inevitable legal procedures which will ensue almost guarantee years of regulatory rule making and additional litigation. The completely unaccounted for socioeconomic impact that we foresee is further delay in achieving optimal use of nuclear power and energy independence for the United States.

We can sympathize with those responsible for establishing environmental radiation standards which are to be "as low as practicable" when the needed data base is so incomplete and subject to change. Yet it seems to us that the EPA has compounded these difficulties in two ways. Not only has one basis for dose standards (health effects) been used while attempting to state the standards on two different bases, but also some rather novel details have been introduced into the procedure for establishing population dose criteria. For example, the basis for using 100 years as the time period for assessing impact is not evident, yet the dose impact of any releases (and presumably any health effects) is most certainly highly dependent on the time period selected. Equally startling is the assignment of the same dose criterion for whole body for all organs of the body other than thyroid. Since the ratio of doses to different parts of the body can be quite dependent on the physical form of release and the subsequent pathways and modes of exposure, release criteria may have no consistent relationship to relative organ doses, and criteria based on "as low as practicable" releases rather than relative radiosensitivity will make little technical sense.

Finally, we feel that the statement on page 15, paragraph 1 is wrong and leaves the wrong impression on the concern the industry has had through the years for establishing good technical standards and maintaining exposures within these standards to the lowest value that is practicable. Certainly standards and guidance contained in FRC Report No. 1[6], ICRP Publication No. 9[7], NCRP Report No. 39[8], and 10 CFR 50 Appendix I are good examples of "external source of standards or guidance" for control of exposure including the "environmental point of view".

We recommend the delay of adoption of proposed 40 CFR 190 until the points above including the ^{14}C and nuclear energy center issues have been resolved and incorporated in the approved Environmental Statement.

Very truly yours,

J. M. Selby, Chairman
State & Federal Legislation Committee

JMS:lsp

cc: Paul L. Ziemer, President, Health Physics Society
Committee Members

References

[1] The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ionizing Radiation, National Academy of Sciences - National Research Council (November, 1972).

[2] NCRP, Review of the Current State of Radiation Protection Philosophy, NCRP Report No. 43 (1975).

[3] Ionizing Radiation: Levels and Effects, A Report of the United Nations Scientific Committee on the Effects of Atomic Radiation to the General Assembly, United Nations (1972).

[4] Environmental Protection Agency, 40CFR190 "Environmental Radiation Protection for Nuclear Power Operations: Proposed Standards," Federal Register, Vol. 40, No. 104, May 29, 1975, p. 23421.

[5] USEPA, Estimates of Ionizing Radiation Doses in the United States 1960-2000, ORP/CSD 72-1 (1972).

[6] Background Material for the Development of Radiation Protection Standards, FRC Report No. 1, Federal Radiation Council (1960).

[7] Radiation Protection: Recommendations of the International Commission on Radiological Protection, ICRP Publication No. 9 (1965).

[8] Basic Radiation Protection Criteria, NCRP Report No. 39, National Council on Radiation Protection and Measurements (1971).

NCRP

National Council on Radiation Protection
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LAURISTON S. TAYLOR, President
E. DALE TROUT, Vice President
W. ROGER NEY, Executive Director

July 24, 1975

Director
Criteria and Standards Division
(AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

The Board of Directors of the National Council on Radiation Protection and Measurements (NCRP) has reviewed the proposed standards (40 CFR Part 190) which the Environmental Protection Agency published in the Federal Register, Volume 40, No. 104 on May 29, 1975, and we are availing ourselves of your invitation for comments.

The dose limits which you proposed in subpart B, paragraph 190.10 are substantially lower than the dose limits proposed for individual members of the public not occupationally exposed as given in NCRP Report 39 under paragraph 245. However, paragraphs 178 and 179 in NCRP Report 39 also recommend that any radiation be kept at a level that is as low as practicable. This admonition was never intended to lead to the setting of new standards lower than those exemplified by the maximum permissible dose equivalents (mpd). The mpd values are believed to be adequate for reasonable protection of any individual. The admonition "as low as practicable" was made to discourage the development of any policy by which radiation workers or members of the public would be indiscriminately exposed at the mpd level. It was intended to force discretion on those controlling the source of radiation.

The limits you propose may be consistent with the capabilities of control technology and may possibly be achieved without undue expenditures, although both of these concepts must necessarily remain somewhat vague.

As such, the limits may represent an appropriate determination of what is as low as practicable. However, we are concerned about the substitution of regulatory controls for the discretion we feel is best exercised by those responsible for irradiation of workers or members of the public. The distinction should certainly be made between the use of limits for design and control purposes on the one hand, as compared to the basic standards on the other hand. The NCRP and the ICRP have been independently studying the question of exposure of the population to ionizing radiation and at the moment there appears to be little likelihood that either organization can find scientific or technical justification for changing their currently published values.

We find ourselves in decided disagreement with some of the premises you state. NCRP Report 43 stresses the serious limitations of linear extrapolations of dose-effect relations. Since the assumption of such linearity is implicit in the concept of the "person-rem" we deprecate its use and advise reconsideration of your announced intention to employ it in future formulation of standards. Furthermore, while the assumption of linearity between dose equivalent of the order of 1 rem and of a few millirem is uncertain, the assumption of linearity between doses of the order of 100 rem and of 1 rem is even more uncertain particularly in the case of low LET radiations. The implication that a dose equivalent of 1 rem will result in some 750 major impairments per 10^6 population is based upon such an extrapolation and its validity is at best conjectural. The Environmental Protection Agency should become aware of increasing doubts regarding such calculations within the very group of scientists who have produced the experimental data upon which the calculations are based.

Sincerely yours,

Lauriston S Taylor
Lauriston S. Taylor

LST:hr

Comments on
Draft Environmental Statement
Environmental Radiation Protection Requirements
for Normal Operations of Activities in the Uranium
Fuel Cycle (May 1975)
and Federal Register Vol. 40, No. 104

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1. The NRC and it predecessor, AEC, has a magnificent record of attention to the environment on the matter of routine emissions of radioactivity. This is acknowledged in your document (and could easily be further demonstrated) and indeed much of your proposed rule is a codification of their standards. The only exception is the requirement for krypton retention at fuel reprocessing plants.

   NRC has been studying this problem intensively (indeed all EPA information on it seems to be derived from their studies) and has been contemplating a krypton retention requirement. It therefore seems inappropriate for EPA to "jump the gun" on this and "force the hand" of NRC.

   It should be noted that the situation regarding fuel reprocessing is a very delicate one at this time, and there may well be subtleties that EPA is overlooking as regards the impact of this rule-making. We should like to urge EPA to check carefully with NRC on whether these rules are acceptable.

2. In this action, EPA seems to be "penny-wise and pound foolish". To cite one example within EPA jurisdiction, the average American gets a hundred times more radiation from building materials than he will ever get from the nuclear energy industry. It therefore seems inappropriate for EPA to worry more about the former, which is receiving no other regulatory attention, than about the latter which is being competently handled by NRC. For example, some building stones give 50 mrem per year to occupants more than others; shouldn't EPA restrict the use of the former, or at least issue warnings about it?

continued ...

There are, as is well known, far larger "fish to be caught" in radiation problems outside of EPA jurisdiction, especially in medical and dental x-rays. If EPA is interested in limiting radiation exposure, wouldn't it be wiser to consider the problem as a whole and exert its influence on other agencies and on Congress to this end. For example, a requirement on use of lead aprons over the body for x-rays of the head, arms, or legs would save hundreds of times more radiation exposure than this rule-making, and would be far cheaper.

3. The section (p. 20, 21) justifying use of the linear - no threshold - dose rate independent model for estimating health effects gives the impression that this model represents the average thinking of biomedical experts. This is clearly not the case. The principal support for it, as referenced in the EPA document, has come from the BEIR Report, but that report clearly states that it is a conservative assumption, much more likely to over-estimate than to under-estimate the effects. In fact it is our understanding that only two members of the 20 member BEIR committee strongly favored use of this model, and none thought it was not sufficiently conservative.

   The U.S. National Committee on Radiation Protection and Measurements (NCRP) has strongly criticized this model (NCRP Report No. 43) as grossly over-estimating effects of low levels of radiation. The United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR) has pointedly refused to accept it as a method of estimating risks.

   In view of this situation, it would seem appropriate for EPA to state that these rules "might possibly save ___ lives" rather than "will save ___ lives."

4. In estimating lives saved by Kr^{85} & C^{14} retention, there is no mention that 94 percent of these lives would be non-American. Clearly it should not be implied that we are unconcerned about killing people in foreign lands, but when one is putting a dollar value on human life as is done in the EPA report, it should be kept in mind that we could save many times more lives in underdeveloped countries

continued ...

with about $1000 per capita worth of food or medical supplies.

In fact, for these people the calculations of radiation effects are grossly exaggerated because they are based on U.S. life expectancy. In a country where life expectancy is 45 years the number of radiation induced cancers per man-rem would probably be about three times smaller.

H.A. Bethe (b/c)

Hans A. Bethe
Professor of Physics
Cornell University
Ithaca, NY

T. Connolly (b/c)

Thomas Connolly
Professor of Mech. Eng.
Stanford University
Stanford, CA

Bernard L. Cohen

Bernard L. Cohen
Professor of Physics
University of Pittsburgh
Pittsburgh, PA 15260

5. The EPA estimates are based on 700×10^{-6} serious health effects per man-rem. It is shown in the attached paper that this is much higher than is justified; that paper was sent to EPA several weeks ago, and no objections to it have been raised. (This item was added by B. L. Cohen at the last minute, and there was insufficient time to check it with the other two co-signers.

Conclusions of the BEIR and UNSCEAR Reports on Radiation Effects per Man-rem

Bernard L. Cohen
University of Pittsburgh, Pittsburgh, PA 15260

ABSTRACT

It is shown that the BEIR Report estimate of cancer risk is 180×10^{-6} deaths per man-rem irrespective of how the dose is administered. For genetic defects, the BEIR Report gives 33 to 800×10^{-6} per man-rem whereas the UNSCEAR Report gives 135×10^{-6} per man-rem to the entire population.

The BEIR[1] and UNSCEAR[2] Reports were prepared by very prestigeous committees, and many groups working on radiation effects claim to use their conclusions. However, the numbers they derive from these Reports seem to vary considerably. For example, the cancer deaths per man-rem from the BEIR Report is taken by the Environmental Protection Agency to be 200×10^{-6} whereas the AEC Reactor Safety study used 100×10^{-6}. The numbers used for genetic defects vary even more widely. It is the purpose of this paper to clarify this matter.

We begin with cancer risk. There are several different calculations of this risk in the BEIR Report but none of them is accepted in the final conclusion. The final judgment of the Committee, as expressed in the Summary of the Report, is "an additional exposure of the U.S. population of 5 rem per 30 years would cause .... approximately 6000 cancer deaths annually." The dose rate given there corresponds to 167 mrem per year (5000÷30), or a population dose of 33×10^6 man-rem per year based on a 2×10^8 population. The risk per man-rem is therefore $6000 \div 33 \times 10^6 = 180 \times 10^{-6}$ cancer deaths per man-rem.

It may be argued that this is for an equilibrium situation from chronic exposure whereas accidents involve a single large exposure. However, with the linearity hypothesis, this can make no difference. To prove this, we may proceed as follows:

Let p_{ik} = probability of a person exposed to 1 rem at age i dying of cancer as a result k years later

n_i = number of people in the population of age i, assumed to be unchanging with time

Single large exposure, R rem

The number of eventual fatalities among those exposed at age i, F_i, is

$$F_i = R \sum_k n_i \, p_{ik}$$

The total number of fatalities, F, is then

$$F = \sum F_i = R \sum_i \sum_k n_i \, p_{ik} \qquad (1)$$

Chronic exposure, r rem/year

The number of fatalities in a given year due to the exposure during a single year k years earlier, f_k, is

$$f_k = r \sum_i n_i \, p_{ik}$$

The total number of fatalities in our given year, f, is obtained by summing this over k, which gives

$$f = r \sum_k \sum_i n_i \, p_{ik} \qquad (2)$$

In comparing (1) and (2) we see that

$$F/R = \frac{f}{r}$$

which says that the fatalities per man-rem from a single exposure is equal to the fatalities per year divided by the man-rem per year for a chronic exposure. Thus the BEIR result, 180×10^{-6} cancer deaths per man-rem, applies to either situation, and in fact to all situations as long as the linearity hypothesis is maintained. To use any number other than this is to reject the conclusions of the BEIR Report.

For genetic defects, the BEIR Report Summary gives 1100 to 27,000 genetic defects per year from 170 mrem/year (or 33×10^6 man-rem per year) in the U.S. This corresponds to 33 to 800×10^{-6} genetic defects per man-rem. One could use the logarithmic median of these, which is about 160×10^{-6}. However, since the range is so broad, it may be preferable to use the UNSCEAR Report which gives a 1% increase per accumulated rad to males in the 3% of all live births which involve mutation-induced defects. Maintaining the population of the US would require about 3×10^6 live births per year (close to the present rate) so we should expect about 900 genetic defects per year per rem of exposure to males prior to conception. If all Americans were exposed to an additional 100 mrem/year, a population exposure of 2×10^7 man-rem per year, the average father would have accumulated 3 rem prior to conception so there would be 2700 additional genetic defects per year. The number of genetic defects per man-rem is then $2700 \div 2 \times 10^7 = 135 \times 10^{-6}$. This is very close to the logarithmic median of the range given by the BEIR Report (160×10^{-6}), so it seems reasonable to accept a number between them such as 150×10^{-6} genetic defects per man-rem.

REFERENCES

1. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation (BEIR Report), National Academy of Sciences, Nov. 1972.
2. Ionizing Radiation: Levels and Effects (Report of United Nations Scientific Committee on Effects of Atomic Radiation) U.N. (New York), 1972.

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130 Endeavor Dr.
Corte Madera, Ca.

July 27, 1975

Director of Critical Studies
Office of Radiation Programs
Environmental Protection Agency
Washinton, D. C. 20460

Dear Sir:

I am writing to express my concern and shock after reading how you have set up the new radiation standards. It is very clear from reading your recent report (40 CFR Part 190) that cost and economics are of a higher priority than that of preserving the life and health of human beings. You state on page 6 of that report, "Since potential effects from radiation exposure are assumed to occur at any level of exposure, it is not possible to specify solely on a health basis an acceptable level of radiation exposure for either individuals or populations; It is necessary to balance the health risks associated with any level of exposure against the costs of achieving that level." That says to me that you are taking it upon yourselves the perogative to inflict injury, cancer, and death on thousands of people in our country --- all for the sake of making electricity and nuclear power!! Your report implies that there is no safe limit of radiation. Dr. John Gofman's studies coincide with your position here. How can you then set standards as you have and work under the name of the Environmental Protection Agency?

Your basic premise that nuclear power is absolutely necessary for our country to function is a questionable premise. People's energy consumption has dropped dramatically the last 18 months. My family's energy consumption is down 25% from 1973. We do not need nuclear power. The risks far outweigh the benefits. And as I and others work to educate people on the effects of radiation on their lives and the lives of generations to come, there will emerge a large voice to say we will n̲o̲t̲ accept the risks that y̲o̲u̲ feel are acceptable.

I urge you to reconsider the whole issue. Are you willing to subject your life and those of your family and children to cancer?

Sincerely yours,

Ellen F. Beans

Ellen F. Beans,
mother of 2 daughters
member of Project Survival

P-18

SIERRA CLUB Mills Tower, San Francisco 94104
Nuclear Energy Policy Subcommittee
R. E. Watt, Ch.
1447 45 th
Los Alamos, N.M. 87544

July 23, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Sir:

Comments offered below are made in response to the Federal Register notice on p 23420 of Vol. 40, #104, dated May 29, 1975 and titled 40CFR Part 190 FRL 376-1, Environmental Radiation Protection for Nuclear Power Operations, Proposed Standards.

Using data included in the AEC's Final Environmental Statement WASH-1258 it is clear that the Environmental Protection Agency's proposed standards would have major impact on both national and worldwide environmental conditions, therefore an Environmental Statement is needed.

Life on Earth has developed with most organisms exposed to the natural radioactive background. Most humans receive a radiation dose from natural sources in the range 80 - 200 mrem/yr (from ORP/SID-72-1), which can be taken as typical for organisms living on Earth's surface. For brevity in this letter the natural background will be taken to be 100 mrem/yr. The proposed standard would allow increases of 25% for the whole body and any organ other than the thyroid, and a 75% increase to the thyroid. Clearly this would be a major increase over normal exposures.

Some of the radionuclides proposed for release would persist in the biosphere for long periods. Our inadequate understanding of the effects of low radiation dose rates and the probability of significant biological concentration factors in many organisms requires that we not pollute our world without more knowledge of the effects that would be produced. Responses given in the FES WASH-1258 show that the limit of 5 mrem/yr can be met with current technology. Most objections to meeting the AEC's proposed 5 mrem/yr limit were made on the basis of cost and the assertion that the "cost/benefit" ratio was too high.

Using a value $100/man-rem for radiation damage and the proposed 25 mrem/yr exposure level, each individual receiving that dose suffers a radiation damage loss of $2.50 per year.

A relatively simple and reliable calculation can be given for the case of krypton 85 (^{85}Kr) releases. Most of the ^{85}Kr remains in the atmosphere, and mixing distributes the gas throughout the troposphere. Mixing between the northern and southern hemispheres may require a few years, but the world-wide man-rem product is only slightly affected by a non-uniform distribution. World population is approximately 3.9 x 10^9 persons, so a world-wide radiation dose of 0.1 mrem would cause damages of \$3.9 x 10^7 to humans, and an unknown amount of damage to other organisms. An accurate estimate of the cost of ^{85}Kr capture and storage is not available so the "cost/benefit" ratio can't be computed. It seems probable that the cost of ^{85}Kr control would be less than \$4 x 10^7.

A radioactive ^{85}Kr concentration of 10^{-11} Ci/m^3 would give a dose rate of approximately 0.1 mrem/yr and would be achieved by distributing 3.4 x 10^7 Ci of ^{85}Kr uniformly throughout the atmosphere. At the proposed rate of release (5 x 10^4 Ci/Gw-yr) the dose rate would reach 0.1 mrem/yr after energy production of 670 Gw-yrs. Using the energy production rates given in Table 2.3.1 on pages 2.3-5 of the Draft Environmental Statement WASH-1539 the dose rate of 0.1 mrem/yr would be surpassed in 1983, and the dose commitment at that time would be 1.5 mrem. The corresponding world-wide damage commitment would be \$6 x 10^8. Clearly restrictions on the rate of release of ^{85}Kr will be needed before 1983 and the permissible rate should not exceed 2.2 x 10^6 Ci/yr for the entire world. The United States' share of such releases should probably not exceed 10^5 Ci/yr. More accurate calculations for all significant isotopes are clearly needed, and can best be discussed in the proposed Environmental Statement.

We request that the Environmental Protection Agency:

(1) set whole body dose rates no higher than 5 mrem/yr and thyroid dose rates no higher than 15 mrem/yr for the general public, pending new regulations to be based on a review of WASH-1258 and a new DES as proposed below.

(2) limit releases of long-lived radionuclides to values such that the combined dose rates produced by them does not exceed 1 mrem/yr to any organism.

(3) follow the procedures specified in the National Environmental Policy Act to propose, and get public comments on, permissible radiation exposure rates for individuals near site boundaries and for larger groups which may be irradiated by releases of specific radionuclides including ^{3}T, ^{14}C, ^{85}Kr and ^{131}I.

The DES should be broad enough to provide exposure estimates for essentially all species of flora and fauna. Areas considered may be different for each radionuclide, depending in its half-life and transport properties, and should be large enough to include at least 90% of the total "organism-rad" dose produced by proposed releases.

Economic damage estimates should be provided wherever possible. Comparison of the social costs to produce a given amount of electric energy by nuclear fission and by alternate means, particularly by coal fired power plants, under EPA's proposed rules should be provided.

Respectfully submitted,

Bob Watt

Dr. Bob E. Watt, Ch. Nuclear Energy Policy

PUBLIC INTEREST RESEARCH GROUP
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SUITE 711
WASHINGTON, D. C. 20036
(202) 833-9700

July 28, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Sirs:

I wish to submit some rather brief comments on the Environmental Protection Agency's (EPA) proposed radiation standards for the nuclear fuel cycle (40 FR 23420). I regret that other demands have prevented me from submitting more detailed comments.

1. The proposed EPA standards would reduce the allowed annual dose to a member of the general population from 500 mrem (or 170 mrem, depending upon interpretation) to 25 mrem whole body dose. In a general philosophical sense, this action should be commended. At a time when the Administration seems bent on rolling back or postponing environmental standards in other areas--as evidenced by proposed amendments to the Clean Air Act, the proposed automobile emission standards moratorium, the strip mining veto, and questionable appointments--it is encouraging that in one area, standards are being tightened.

I will, however, withhold comment at this time on the absolute adequacy of the proposed standards. Others concerned with the public interest, and with greater expertise than myself, will be submitting detailed comments on the standards' adequacy.

2. There is one aspect of the standards which is disturbing. The language of the proposed standards states these standards are for "planned" releases of radioactivity. There are two aspects of this language which are bothersome. First, there is no definition of "planned". Does this mean, for example, that if a licensee releases an excessive amount of radiation, he can characterize it as "unplanned" and circumvent any restrictions on his emissions for the remainder of the year? Secondly, although EPA has performed an evaluation of the environmental effects of planned releases, there has not been, to my knowledge, any evaluation of the effects of unplanned releases. Each unplanned release appears to be considered a "case closed" with a utility or Nuclear Regulatory Commission (NRC) announcement that no persons were injured. There has not been an evaluation of what the cumulative effects to the environment and the public of all spills, leaks, and unplanned releases might have been.

It would seem that such an evaluation of "unplanned" effects would be necessary to adequately set standards for "planned" releases. If the expected unplanned releases would cause significant health effects, then it would be necessary to compensate by reducing standards for planned releases. I recommend that the EPA or NRC perform an evaluation of the cumulative effects of unplanned releases from the nuclear fuel cycle. Without such an evaluation, there can be no assurance that the standards for planned releases will keep the combined health effects from planned and unplanned releases at "acceptable" levels.

Yours truly,

John Abbotts

John Abbotts

Enfield CT
July 29, 1975

Director, Criteria & Standards Division
AW-560
Office of Radiation Programs
E. P.A.
Washington, DC 20460

Dear Sir,

Thank you for the opportunity to comment on the Draft Environmental Statement for "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle."

The report seemed well-written & well-edited; the only "typo" I found was on page 33, center paragraph, 5th line "complementary" was misspelled "complimentary".

My only complaint—which could be a major one—is that, after re-reading the report several times, there is no substantive explanation as to how the EPA standards (by what methods, or for what reason) will be the slightly more conservative than the 10CFR50 Appendix I requirements. Table 10 says the EPA standards will be more restrictive; the text never really justifies this table.

I would appreciate a copy of the Final Environmental Statement when it is written

Very truly yours,
Neal E. Wilson
NEWilson
5 Brook Rd
Enfield, CT 06082

P-21

INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
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IN REPLY PLEASE REFER TO
PRIERE DE RAPPELER LA RÉFÉRENCE 0/340-87

1975-07-28

Dear Bill,

I've recently reviewed your proposed EPA standards for environmental protection for nuclear power operations and would like to commend you and your staff on a job well done. I believe the approach you have taken is a step in the right direction and should be continued.

We have had a problem, however, in understanding how the estimated cost effectiveness of $ 75/person-rem (cost for implementing proposed standards) was derived. In the same regard we have had difficulty in reproducing the cost effectiveness curves in Part III (Fuel Reprocessing and Waste Management) of your "Environmental Analysis of the Uranium Fuel Cycle".

I would greatly appreciate it if you could provide us with the assumptions and calculations on which these figures were based.

Thank you very much.

Sincerely yours,

for: Jerry J. Cohen
Joint IAEA/IIASA
Research Project

Mr. William D. Rowe
Office of Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460
United States of America

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BNL AUI
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ASSOCIATED UNIVERSITIES, INC., UPTON, L.I., N.Y. 11973

HEALTH PHYSICS & SAFETY DIVISION

TELEPHONE: (516) 345-4210

August 12, 1975

Dr. William A. Mills, Director
Criteria & Standards Division (AW-560)
Office of Radiation Protection Programs
Washington DC 20460

Dear Dr. Mills:

Enclosed are comments with regard to the Proposed Standards on "Environmental Radiation Protection for Nuclear Power Operations", 40 CFR Part 190 as published in the Federal Register on May 29, 1975. Due to the pressure of other professional responsibilities, I have not been able to complete them by the indicated end of the comment period. I remain hopeful that they are not unduly late for consideration.

The indicated intent of the proposed standards is the "protection of the general public for unnecessary radiation exposures and radioactive materials in the general environment resulting from the normal operations of facilities comprising the uranium fuel cycle". Upon first consideration, such an intent appears commendable and appropriate to EPA's mandate under Reorganization Plan No. 3. However, a review of the experience to date and projections from it of future expectations under the aegis of licensing and regulatory agencies (particularly the former Atomic Energy Commission and its successor Nuclear Regulatory Commission), discloses few loopholes involving what might be adjudged an "unnecessary" exposure of the public that would be closed by the proposed standards. Additionally, in many specifics the proposed standards depart from their announced intent to protect "the general public", and become de facto standards for the protection of individuals in the immediate vicinity of nuclear facilities. Insofar as this is so, they seem to me redundant, confusing and to contribute little if any to meaningful health protection of the general public.

Additionally, in my judgment, the inclusion of specific quantity release limits in a standard for the protection of the general public is inappropriate, especially when unaccompanied by any indication of the environmental pathway model and assumptions insofar as it may mislead the public as to the significance of such releases and of the protection being afforded by the proposed limitations.

As indicated in the published explanatory preface to the proposed standards, the current guidance for radiological protection of the public from nuclear facility operations has had as its primary focus

INFORMATION OPERATOR (516) 345-2123

the most exposed individual, rather than the limitation of the dose to the total population from a specific type of activity. However, it should be observed in this connection that Part 20 "Standards for Protection Against Radiation" [Paragraph 20.106(e)] does consider a "suitable sample of an exposed population" and the restriction of effluents from a given facility if it appears that daily intake by such a population group of radioactive material, averaged over a year, would exceed the daily intake from continuous exposure at one-third of the concentration guides generally corresponding to a whole body dose of 500 mrem/yr or an individual organ dose of 1,500 mrem/yr.

The explanatory preface of the proposed standard suggests that with the anticipated expanded development of the nuclear industry, it appears as important to consider the potential radiological impact on the surrounding (and in some cases worldwide) population, as on the most exposed individuals most nearby to a nuclear facility. In point of fact, effluent discharges from most AEC-NRC licensed or operated nuclear facilities have been small fractions (a few percent) of release limits derived from current radiation protection standards based on direct exposure of individuals in unrestricted areas or concentration guides for air, water or foods consumed by the most exposed nearby individuals.

Of the several steps in the nuclear fuel cycle, nuclear power reactors currently appear to produce the largerst population dose, and fuel reprocessing facilities the next largest. The other steps, mining, milling, fabrication and waste disposal seem relatively insignificant. In the extreme, airborne effluents from a few nuclear power reactors appear to have produced a few hundred person-rem/year in the surrounding population with 80 km, and more typically, a few tens of person-rems. Liquid effluents have been insignificant by comparison, as a source of general population exposure. By comparison, the average yearly dose from naturally occurring radioactivity to a typical population (1.5×10^6 persons) in the vicinity of a nuclear power facility is about 2.0×10^5 person-rems.

After making what appeared to me a strong and convincing argument for population related standards based on total dose commitment expressed in person-rems, a complete reversal is made in the explanatory preface to support individual dose and quantity release limits. It is stated that, "the environmental models used in deriving these (population dose) assessments, while useful for making estimates of potential health impact, are not considered to be so well-defined as to allow standards for the populations to be expressed directly in terms requiring their explicit use". In the absence of supporting evidence, this appears an arbitrary judgment which effectively circumvents the OMB Direction of 12/7/73 limiting EPA's authority to settling standards for the "total amount of radiation in the environment from all facilities". It is difficult to comprehend why the environmental models used by EPA to estimate health effects with seeming great confidence (lacking any indication of range) in undergirding reports such as EPA 520/4-73-002, EPA 520/9-73-003, cannot be used with equal confidence to set population standards directly in person-rems.

As indicated in Table IV of the enclosed paper, "Reactor Effluents: As Low as Practicable or as Low as Reasonable" (Nuclear News, 15:11, November 1972), other countries have made population dose allocation for the nuclear fuel cycle. I cannot understand why this was not done in the U.S. several years ago. On one hand, it would have made sense as a precautionary measure to prevent any one sector (including the nuclear power fuel cycle) from utilizing the entire general population 30 year dose limit of 5.0 rem, as recommended by the ICRP. On the other, it was obvious from the early experience of the industry that population doses occasioned by it were small fractions of the ICRP limit. In my judgment a reasonable allocation based on this experience would have cost very little, and would have removed any basis for the unfounded inferences made widely a few years ago by Drs. Gofman and Tamplin, that nuclear power might produce a U.S. population-wide exposure "at the FRC limit of 170 millirems per year" and thereby produce 16,000 or 32,000 or even 104,000 cancer deaths per year.

By setting forth somewhat better founded and somewhat less sensational numbers of "health effects" without careful qualification that under the circumstances of the assumption of the linear hypothesis these are very likely upper limit estimates for which the lower limit may approach zero , in my judgment EPA is playing the Gofman-Tamplin game of using the public's hyperphobia of radiation and radioactivity for its own ends. Numbers of health effects, when set forth without this qualification, and with no attempt to place them in the context of their overall prevailing incidence, seem more calculated to alarm than to inform as a basis for sound public policy.

For many, if not most nuclear effluent releases, the most exposed individual is immediate or adjacent to the originating facility site boundary. Thus, although the proposed standards are supposedly intended to "assure the protection of the public from unnecessary radiation exposures"; when set in the form of limits "applicable to any member of the public", they become de facto facility standards. Via the back door, they put EPA in the business of superseding the judgment of NRC on matters in which the latter appears to have more competence by virtue of first-hand knowledge, experience and staff to make pertinent in depth analyses. As illustration, I suggest the impressive detail in the AEC Regulatory Staff (now NRC) backup materials for the Appendix I proceedings.

In the prefatory explanation of the proposed standards it is furthermore argued that, "it is inequitable to permit doses to specific individuals (presumably those who reside close to a nuclear site) that might be substantially higher than those to other members of the public from other radionuclides. Although this argument has egalitarian appeal, I find that it does not seem to be uniformly applied as an overall EPA protection philosophy. In Table V of the enclosed paper, "Comparing Effluent Releases from Nuclear and Fossil-Fueled Power Plants" (Nuclear News, 16:4, April 1974), I have shown that using average meteorology, yearly average air concentrations of SO_2 and NO_x approach or exceed EPA "population" air quality standards at the site boundary of large coal- and oil-fueled power plants.

Clearly, the most nearby individuals are at greater health risk from these agents than populations more distant. In my oral testimony of 6/6/74 to the AEC Commissioners, a copy of which is also enclosed, in the section on "Risk Comparisons" (pages 6-7) I have also commented specifically on the incongruity of holding radiation risks to a much lower level than those from power plant effluents (at current estimates) and on the inconsistency of limiting site boundary radiation exposures to acceptable "general population" levels, as compared to the generally prevailing attitude for conventionally hazardous technological activities.

The specific limits proposed in the standards, 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ, appear reasonable and achievable, if applied on a general population, rather than individual basis. However, in my judgment, it would be desirable to have these limits related to the benefit, the amount of installed power capacity (or that produced). In the paper, "As Low as Practicable or As Low as Reasonable", I have proposed such a scheme which I commend to your attention.

Although not as qualified to speak to the availability, practicability and economics of radwaste control technology as I am to environmental radioactivity; as indicated above, I have serious reservations about the wisdom or appropriateness of including quantity release limits in an environmental radiation protection standard. In my judgment, the pertinent issue is the dose to the population and not the amounts released. The derivation of quantity release limits from the latter necessitates an environmental model and many assumptions about pathways, transfer co-efficients, discrimination factors and uptake rates. The current poor definition of these models, is alluded to in the EPA argument against directly stated population dose limits. It seems to me that the same argument applies against quantity release limits (with the possible exception of ^{85}Kr, for which the environmental model is least complicated).

Specifically with regard to ^{85}Kr, from my calculations I assume that the intent of the proposed standard is that it be substantially removed from fuel reprocessing plant off-gas streams, and contained for "long-term" waste disposal. I would encourage such removal and containment for the reason that the anticipated atmospheric concentrations of ^{85}Kr by the year 2000 without such measures could be a major annoyance in low background counting, long before they could pose a significant radiological problem. I question the need or cost-effectiveness of the application of such removal technology to power reactor effluent gas streams.

Although ^{129}I has an effective "infinite" half-life, with regard to the human time scale, even without any removal the total amounts created by the nuclear fuel cycle during the next century seem small relative to the total world-wide inventory of long-lived naturally occurring radioactivity on or near the earth's surface. However, since iodine removal at or close to 10^3 is commonly employed for the removal of ^{131}I from gas streams, the cleanup of ^{129}I from fuel reprocessing plant off gas streams by a comparable factor should be practicable. However, this is more sensible with a view toward minimizing local concentrations, than with the questionable one of "containing" ^{129}I for even an appreciable fraction of its half life.

The proposed release limit for long-lived transuranics seems extraordinarily restrictive, considering the experience with them to date. Unclassified references (i.e. G.P. Dix and T.J. Dohry, "Critical Parameters in Plutonium Safety Evaluations", Health Physics, 22:6, 569-574, June, 1972) suggest that about 5×10^5 Ci of ^{239}Pu and lesser amounts of other transuranics have been distributed over the surface of the earth as a result of atmospheric weapons testing. The current Northern Hemispheric deposition of ^{239}Pu is about 2 nCi/m^2 (or about 2×10^4 Ci over the land area of the U.S.). A related 18-year (1954-1972) dose to the lung of 15 mrem has been calculated (B.C. Bennett, "Fallout ^{239}Pu Dose to Man", HASL-278, 1/1/74). The release of 0.5 $mCi/Gw^{(e)}$-year from ~ 1,000 Gw capacity for 50 years, if uniformly deposited over the U.S. would accumulate to 2,500 Ci. Scaling from the fallout ^{239}Pu experience, a 50 year dose to the lungs of about 5 mrem would be anticipated. This seems a considerable overestimation, since most of the ^{239}Pu released at ground level or from stacks of AEC facilities appears to have remained deposited nearby, so that the EPA assumption of U.S.-wide distribution of analogous materials from the nuclear fuel cycle seems questionable. If, as claimed by EPA, a standard of 0.5 $Ci/Gw^{(e)}$-year is "reasonably achievable using currently available control methods", then well and good. But, it does not seem a goal worth pushing very hard toward, when one considers that the alpha dose to the basal cells at the bronchi from the inhalation of naturally occurring ^{222}Rn range from 280-1,490 mrem/yr (Table 15, Vol 1, UNSCEAR, 1972).

It is indicated that "the standards represent the lowest radiation levels at which the Agency has determined that the costs of control are justified by the reduction in health risk." The assumptions of the linear hypothesis and of BEIR risk-estimates is acknowledged. Obviously, the evaluation of benefit (health risk reduction) achieved under the proposed standard is crucially dependent on the validity of the above assumptions. In a recent paper, "Radioactive Effluent Releases and Public Acceptance at Nuclear Facility Sites" [Siting of Nuclear Facilities, IAEA SM-188 (1975)], I have reviewed evidence for doubting the pertinence of this assumption and of the BEIR risk estimates. It is my belief that scientific standards setting groups may soon give official recognition to the evidence of a reduced risk from low-dose, low dose-rate radiations (such as those occasioned by effluents from the nuclear power cycle). Since there seems no current urgency for the proposed EPA standards, I would urge that they be delayed until these pronouncements are made or until the need does seem more urgent.

Two orders of magnitude greater whole-body environmental doses to the U.S. population are expected from natural radiation than those anticipated from the nuclear power activities energy in the year 2000 (see Table II-26, ORP/CSD 72-1). If EPA is concerned about reducing hypothetical health effects in the general population from low-level radiation, then it seems to me that a correspondingly higher priority should be given to this background and the related health effects than to nuclear power cycle. Although natural radiation is a "given" there are obvious strategies (choice of location, building materials, diet) that could minimize such exposures. Until their cost-benefit effectiveness is examined, I am not convinced that the promulgation of standards to limit small increments from nuclear power are where EPA should be putting its efforts. In this connection I call attention to the lack of discernible health effects in populations living in high background areas within the U.S., as revealed by a recent study of the state by state incidence of cancer in the U.S. between 1950 and 1967 (N. Frigerio et al, ANL/ES-26 (1973), which is also summarized in the above paper.

Beyond the questionable priority which the proposed standards have within overall priorities for the protection of the public from unnecessary exposure to radiation, I suggest that they are even more questionable when viewed within the overall context of public health priorities. In my judgment, it is not sufficient simply to make a cost-effectiveness assessment within the narrow confines of radiological health. Rather such standards and the expenditures they may occasion should be viewed within the context of the overall level of risk-benefit for the total spectrum of health standards, risks and expenditures. The following table of representative U.S. public health and safety risks is illustrative. The projected hypothetical risk and mortality from nuclear power (which may be exaggerated at the BEIR dose-effect risk estimates), appears to be orders of magnitude less than most (if not every) other health risk for which actual mortality data is available.

As a health physicist who has been involved for a number of years in public information efforts, I am well aware of the climate of popular misunderstanding and fear which prevails with regard to radiation hazards. Clearly, the public is entitled to whatever degree of radiation protection it desires. But it seems to me that the radiation protection community has a professional obligation to do its best to minimize these fears, to set the truth, the whole truth, and nothing but the truth (as best we perceive it) before the public. In my judgment this means stating candidly that the present and projected risks from nuclear power, as influenced by the current ICRP-NCRP-FRC standards, are insignificant relative to a broad spectrum of man-made and naturally occasioned risks (as enumerated in Table I), and that public expenditures for the betterment of health might more rewardingly be directed to these areas than toward still more radiation effluent control technology and environmental monitoring effort.

In summary, let me suggest that however much the proposed standards wear the "god and motherhood" mantle of protecting the public from unnecessary radiation exposures; applied to nuclear power it focuses on an insignificant source of such exposures, and ignores the major sources of the exposure of the public to radiation. As such, they seem to me more like a cynical attempt on EPA's part to look good politically than to offer any meaningful increment of public health protection that would not occur in the absence of the standards.

Yours truly,

Andrew P. Hull

Table I

U.S. Public Health & Safety Risks

	Average Annual Individual Risk	Total Approximate Annual Mortality
Heart Disease	5×10^{-3}	1,000,000
Cancer	1.5×10^{-3}	300,000
Accidents	6×10^{-4}	120,000
Automobile Accidents	2.5×10^{-4}	50,000
Suicide	1×10^{-4}	20,000
Air Pollution*	7.5×10^{-5}	15,000
Homocide	5×10^{-5}	10,000
Tuberculosis	3×10^{-5}	6,000
Natural Radiation (130 mR/yr, BEIR)	2.6×10^{-5}	5,200
Electrocution	2×10^{-5}	4,000
X-Rays (~100 mr, linear hypothesis)	2×10^{-5}	4,000
Choking	1.8×10^{-5}	3,600
Natural Disasters	1×10^{-6}	200
Nuclear Power, 1,000 Gw(e) reactors (for average** population dose of 0.15 mR/yr)	3×10^{-8}	6

*About 50% from fossil-fueled power plant effluents.

**Table II-26, ORP/CSD 72-1. An "individual" site boundary of 25 mR/yr can be projected to produce a somewhat smaller average population dose.

3900 Cashion Pl.
Oklahoma C , Okla. 73112
Wed. Sept 3, 1975

Director
Criteria and Standards Division, AW 560
E.P.A.
401 M St. S.W.
Washington, D.C. 20460

Dear Sir,

I am sorry to be late submitting my comments on the proposed radiation standards for nuclear power, May 23, 1975, but we were out of town on vacation and not aware the new standards were released. However, what is one month more or less when we are talking about the half-life of plutonium, 24,000 years, or that of iodine 129 chalking up an impressive 17 million years.

I consider the word standards a misnomer- the proper term should be radiation suggestions. As I read it, let me paraphrase what you are really saying to the nuclear industry:

"Won't you please try to meet our criteria if it doesn't inconvenience you or cost you very much. No great hurry about it. You have 2 years to comply with regular emission standards, and 8 years to lower emissions of krypton 85 and iodine 129. We will be as understanding as possible about accidental releases. After all, accidental releases aren't as hard on biological systems as routine releases, so they don't count. Everybody makes mistakes. However it is advisable to avoid accidents, if possible- they might get the public agitated. We encourage you to build multiple facilities on a site by shifting guidelines from a site to a reactor basis. People foolish enough to live close to a cluster of 5 or 10 reactors could get five to ten times as much radiation. The smart ones will probably move to a better neighborhood. The most important thing is to keep the electricity flowing and the costs down. Of course, we don't want any embarrass- ing epidemics of cancer, infant mortality, leukemia, birth defects and ill health so lets keep the standards high enough so that the results aren't too obvious. We've provided a few pacifiers to the Nervous Nellies, but we are really right in there, guys, helping promote nuclear energy and making it profitable."

Some of the same attitude is expressed by Chauncey Starr in Fortune, May, 1973, page 310. A major release of radiation to the environment is being discussed ....." in a city the size and density of Los Angeles, something like 5000 addition- al lethal cancer cases would develop in ten years. As serious as that sounds, it would be virtually undetectable, because during that same period the city would experience about 150,000 deaths from cancer anyway. "If you didn't know about the nuclear accident," says Starr, "you would never be able to learn about it from the public health statistics."

But, allow me to comment on various statements made in his opening statement by Administration Russell Train. Page 1, it is unfortunate that mines are not included. The death rates for lung cancer of uranium miners is a national disgrace, as has been the handling of the mine tailings. I hope strict regulations will be set up soon.

On page 2, Mr. Train said the standards do not apply to recycled plutonium nor to uranium based electric power production. We live close to the Kerr McGee Plutonium

Fuel Fabrication Plant at Crescent, Okla. This company is now having serious problems handling its plutonium safely, as is the Rocky Flats facility near Denver. I realize that recycled plutonium has from 5 to 10 times the penetrating radiation as the plutonium being handled there now. But there is the very real possibility of permanent contamination of the area here now. With each nuclear reactor pro- ducing about 200 kilograms of plutonium 239 a year, and an accumulation of about 10 million pounds by the year 2000, we should consider much more carefully than we have up to now the carcinogenic properties of even microgram amounts for up to a quarter of a million years. Even though E.P.A. may be forgiving of nuclear accidents, the plutonium economy is most unforgiving.

On page 2, second paragraph, Mr Train also states that "At that time (1970) even more than now, the significance of exposure of members of the public to radio- active materials was a hotly contested public issue." It is still a hotly contested public issue. The only change is that the nuclear industry has tried to detoxify radioactive materials such as plutonium with words and the typewriter, poo pooing the dangers. For example, the statement by Robert Thorne, Acting Deputy, Asst. Administrator for Nuclear Energy, ERDA before the Subcommittee on Energy and the Environment, Comm on Interior and Insular Affairs, House of Representives, May 1, 1975, page 7. "We know that some five tons of plutonium were dispersed over the globe from atmospheric testing of nuclear weapons prior to 1963. Essentially all of this has now settled to the ground. There has been no cancer found in man which can be confidently attributed to plutonium." Russian scientists said years ago, and now Dr. John Gofman has issued a report saying that such tests would cause a million cancers worldwide. EPA cannot act too quickly or too strictly on plutonium emissions. If we go to plutonium recycle, it may then be too late.

On page 3 I would question the term balancing judgement. I sounds like the nuclear lobbying groups who want to present a balanced judgement on nuclear power, which is, of course, a pro judgement. A balanced judgment means of course that some people will be dying from the effects of acceptable releases of radiation. Hopefully not you or me, but somebody. As Mr. Starr has stated, a few more cancer deaths wouldn't be noticed.

I would agree with the idea of "environmental dose comitment" on page 4. It involves a moral judgement of protecting future generations. In promoting nuclear power, our government and industries have given very little thought to future generations in our radioactive contamination of our ecosystem and our residue of radioactive wastes. As a very short link in the long chain of life, we must consider those people and animals that come after us.

On page 5, the reduction of in excess of 1000 cancer cases by the proposed new standards is a misleading statement and meaningless. How many cases of ill health, genetic defects and cancer are caused by the allowable radiation releases. It is indeed unfortunate that N.R.C., E.P.A., American Cancer Society, etc. have not done meaningful research on the relation of radiation to cancer. Not since the Gofman and Tamplin report has any effort been made on a large scale to study the effects of radiation exposure on human health. The B.E.I.R. report was an attempt to come up with some sort of standards. In talking to Dr. Edward Martell, of the National Center of Atmospheric Research at Boulder, Colo, who is presently doing research on the subject, he fears there is a much more close and alarming connection than had previously been suspected. Even at present standards, of 170 millirems per person per year, the BEIR report estimates a 5 % increase in ill health and up to 32,000 extra cancer deaths per year. If we reduce the allowable standards by 20 fold, but increase nuclear power plants 10 fold, we really aren't doing very much.

Many of us had hoped that the allowable emissions would be reduced a hundred fold.

My question to Mr. Train is this, in the contest over the orderly delivery of electrical power, and human suffering, which gets priority. In his last sentence he said "We have concluded, there one, that the economic impact of these proposed standards would be minimal. Mr. Train, inthe contest over cost and human life, which gets priority.

Dixy Lee Ray, former Chairman of the AEC, together with Admiral Elmer Zumwalt has now become a lobbyist for "Americans for Energy Independence". Craig Hosmer, former member of the Joint Comm. for Atomic Energy has signed on with another lobbying group called "American Nuclear Energy Council" with a budget of $500,000. The Atomic Industrial Forum has doubled their budget from $600,000 to $1,000,000 to promote nuclear energy. And, you and I and the human race looses, and sadly nobody cares.

Ilene Younghein
Ilene Younghein

We still have a 500-1000 year supply of coal. We could also develop solar, wind and geothermal energy. We could develop a conservation ethic. We don't have to have nuclear energy- at least not in the forseeable futuke. Setting up strict radiation standards might just force upon us a much happier and safer form of energy- solar and wind.

Sat. Sept 6, 1975
3900 Cashion Pl.
Okla. City, Okla. 73112

Director
Cariteria and Standards Div. AW 560
Environmental Protection Agency
401 M. St. S.W.
Washington D.C. 20460

Dear Sir,

Since my letter to you on Sept. 3, I looked through my notebooks, and ran across several items that I wanted to call to your attention regarding E.P.A.'s proposed new guidelines regarding radiation emissions from nuclear power plants. In April, 1975, Readers Digest, Ralph Lapp in the article "Nuclear Reactors, How Dangerous?" says, "I have estimated that for the period 1970 to 2000 some 200,000 Americans will experience cancer death due to the unavoidable natural radiation....."The cancer toll accociated with radiation diagnostic examinations will result in 100,000 more deaths.... All in all, I estimate that air-travel radiation risks will add up to a cancer toll of 7200 fatalities in the 1970-2000 time span. In contrast, the cancer toll from the routine release of radioactivity from nuclear power installations- allowing for 1000 reactors by the end of the century-will be a maximum of 90 deaths."

In contrast Russell Train, in his statement of May 23, 1975 said that lowering the present standards from the allowable 170 millirems per person per year from nuclear energy facilities to 25 millirems to the whole body, or 75 millirems to the thyroid would avoid in excess of 1000 cancer deaths. My mathematics are a little fuzzy here, but, I come up with a negative 910 people. I suspect Train is closer being accurate than Lapp in view of the Biological Effects of Ionizing Radiation report put out by the National Academy of Science that the present standard of 170 millirems could lead to up to 32,000 extra cancer deaths a year. Just how many cancer deaths does the E.P.A. estimate there will be between now and the year 2000 with 1000 reactors with allowable exposure to the public of 25 millirems to the whole body and 75 millirems to the thyroid?

I also, can't quite figure out Mr. Trains twenty fold reduction from the old standards. From 170 millirems to 25 is more like a seven fold reduction.

According to Donald Oakley of your E.P.A. in his report "Natural Radiation Exposure in the U.S." (Environment, Dec. 1973) natural radiation from all sources is 88 millirems per year per person in the United States. There are of course differences in different localities, but that is average. This figure makes the E.P.A.'s proposed new standards to thyroid nearly the amount that persons would be getting from natural radiation and whole body doses between one-third and one fourth. Your standards are bound to cause cancer, leukemia, genetic damage, premature aging and death in a large number of people.

A limit should be set for the maximum amount that a member of the public can be exposed to rather than setting limits for the amount that each reactor or facility can release. Maybe some people don't enjoy being sacrificed, like the ancient Aztecs offered people up as sacrifices to their sun god, so that others can continue on their energy binge.

The old A.E.C. had a way of burying reports unfavorable to nuclear energy about as often as a squirrel buries nuts. I have the feeling that the new N.R.C. won't be much better. It certainly is to be hoped that the EPA will at least appoint

2.

the citizens of this country with the health and environmental hazards of the nuclear industry.

I am concerned also with the methods and language for enforcing your new standards, which are pretty wishy-washy. A headline in the New York Times, Son. Aug 25, 1974 says "A.E.C. Penalizes Few Nuclear Facilities Despite Thousands of Safety Violations. From your stated objective of not wantin to jeopardize the uninterupted flow of electricity, I expect only more of the same. Instead of the 3,333 violations for the year ending June 30, 74, with something like 50 reactors, we can expect 66,660 violations and accidents if we have 1000 reactors in the year 2000. And, EPA says accidental releases don't count.

Women tamed the West- maybe we can also bring more human considerations in the life threatening and human-future threatening nuclear industry.

Best regards,
Ilene Younghein
Ilene Younghein

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September 15, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Re: Draft Environmental Statement, Environmental Protection Requirements for Normal Operations in the Uranium Fuel Cycle, and Proposed Regulations to be added to Title 40, Code of Federal Regulations, "Part 190-Environmental Radiation Protection Standards for Nuclear Power Plants."

Dear Sir:

Enclosed are the comments of the Natural Resources Defense Council, Inc. (NRDC) on the above-captioned matters. If any questions arise about our comments, do not hesitate to contact us.

We encourage the Environmental Protection Agency to hold meaningful hearings on the proposed regulations and supporting environmental impact statement. However, in considering whether or not to send a representative on behalf of NRDC, we will have to weigh carefully the cost in time and money to attend the hearing compared to the likelihood of enriching and advancing the discussion on the adequacy of the proposed regulations and environmental impact analysis. We will also want to know in advance, for instance, the membership of the Hearing Board, the Board's responsibilities, and the procedures for the Hearing. In our opinion, the Board should not be closely identified with the nuclear industry, and the Board should be sympathetic to citizen participation in the Hearing and the setting of EPA's standards. We also favor an opportunity for participants to ask EPA officials and other participants questions, including follow-up questions.

Additionally, we ask EPA to respond formally to written submissions prior to public hearings. In this way, the public will be better able to build on a full exchange of information and viewpoints and will not be reduced to repeating the previously submitted comments, an exercise that has little substantive value in our view.

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Director
Criteria and Standards Division
U.S. Environmental Protection Agency
September 15, 1975
Page two

Finally, we urge EPA to hold at least one hearing on the West Coast in order to afford a more practical opportunity for participation by citizen groups and individuals in the West. Hearings in the East rarely can be attended by western citizens due to the high expense of travel and the difficulty in making enough time available.

Sincerely yours,

Terry R. Lash

Terry R. Lash, Ph.D.
Staff Scientist

TRL:gg

Enclosure

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Comments
Of The
Natural Resources Defense Council
On The
Environmental Protection Agency's
Draft Environmental Statement
ENVIRONMENTAL RADIATION PROTECTION REQUIREMENTS FOR NORMAL OPERATIONS OF ACTIVITIES IN THE URANIUM FUEL CYCLE
And
PART 190-ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR NUCLEAR POWER OPERATIONS

Submitted by:

Terry R. Lash, Ph.D.

With the assistance of:
John W. Gofman, M.D., Ph.D.

September 15, 1975

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I

INTRODUCTION

The Natural Resources Defense Council, Inc. (NRDC) submits these comments on the draft environmental impact statement, Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, and the proposed regulations, "Part 190--Environmental Radiation Protection Standards for Nuclear Power Operations," prepared by the United States Environmental Protection Agency (EPA).[1] The draft statement analyzes proposed limits for radiation exposure of the general public and the release of some radionuclides to the environment due to the planned operation of the nuclear power industry. For the reasons stated in detail below, we believe that the draft statement and the course of inquiry reflected therein do not satisfy the requirements of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. §§ 4321-4347 (1970).

Most importantly, we submit that EPA, in preparing this impact statement and proposing new regulations, must first consider and evaluate fully the total cumulative radiological damage that may result from the radioactive emissions of a large scale nuclear power industry. Second, EPA must describe completely its program to ensure adequate protection of the general public and the environment from radiation exposure due to releases of radionuclides from the uranium fuel cycle. The fundamental issue is whether or not the perceived short-term benefits of the electricity generated at nuclear power plants will be worth the inevitable very long-term radiation exposure of the public and radioactive contamination of the environment. However, by narrowly restricting the scope of the draft statement to an incomplete analysis of the radiological damage from only a few radioactive contaminants during just 100 years, instead of considering all significant radionuclides for the thousands of years that some of the contaminants will remain hazardous, and by ignoring entirely the serious ill-health effects that will be imposed on future generations from prior occupational exposures of nuclear workers, EPA has substantially underestimated the total human ill-health and deleterious environmental effects of a large nuclear power industry. In fact, despite assurances that a comprehensive approach was adopted, the draft statement never seriously considers the total public health and environmental implications of possible future national reliance on nuclear power as a major source of electrical energy generation.

To compare the consequences of releasing various amounts of radioactive materials to the environment and to evaluate the necessity for more or less strict limits on such releases for decision-making purposes, the total long-term impact of all significant radionuclides that may be released to the environment from the entire uranium fuel cycle must be evaluated. No important radionuclide can be omitted from the analysis; no portion of the fuel cycle can be excluded. The draft statement fails to compare alternative regulatory schemes on such a comprehensive basis.

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[1] 40 Fed. Reg. 23240 et seq., May 29, 1975. These comments supplement NRDC's July 1, 1974, submission in response to EPA's announcement of intent to promulgate environmental radiation protection standards (39 Fed. Reg. 16906, May 10, 1974).

Even worse, however, the draft statement -- apparently based on its incomplete and wholly inadequate analysis of the potential hazards -- enthusiastically touts nuclear power as playing ". . . an essential and major role in meeting national power needs during the next several decades." (p. 1)[2] Since the draft statement contains no analysis of "national power needs" or of alternative methods for meeting those needs, EPA's assertion stands completely unsupported. In NRDC's view, it is also inaccurate and out of place in view of EPA's responsibilities. The strong promotional tone in the draft statement forcefully raises a substantial question of whether or not the primary aim of the new regulations is to protect the public health and environment fully from radiation damage or to facilitate the rapid commercialization of nuclear power. This latter purpose would be wholly inappropriate in a draft statement prepared by the Agency with principal responsibility for protecting the public from an unhealthful environment.[3]

The following major deficiencies exist in the draft statement:

1. The entire uranium fuel cycle is not considered; specifically, the deleterious effects of radioactive releases from uranium mines, mill tailings piles, mixed-oxide fuel fabrication plants, non-operating facilities (including facilities undergoing decommissioning), and waste disposal sites are not evaluated.

2. The long-term human ill-health effects due to the routine release of several potentially significant radionuclides, e.g., radon-22 (and its decay products), strontium-90, and cesium-137, are not assessed.

3. The total human ill-health effects resulting from the release of radionuclides, with very long half-lives, such as carbon-14, are substantially underestimated, because the analysis is arbitrarily terminated at only 100 years after the radionuclides enter the environment.

4. The significant deleterious health effects in subsequent generations produced by gonadal and fetal radiation exposure of workers at nuclear facilities are excluded from evaluation.

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[2] Unless otherwise indicated, page numbers refer to pages of the draft environmental impact statement. See also p. 9.

[3] In any event, if a strong claim for the necessity of a large nuclear power industry is to be made in the statement, all of the disadvantages of the large-scale development of nuclear power must be fully analyzed and compared to all reasonable alternative means for meeting the nation's energy needs. Of course, this draft statement fails totally to substantiate such a claim, or even to attempt to conduct such an analysis. Rather, the conclusion is merely asserted. In light of the serious technical, economic and political difficulties currently facing the nuclear power industry, we believe EPA's conclusion about the advisability of nuclear power is wholly unjustified.

5. The possible extent of "unplanned" releases of radionuclides is not assessed.

6. There is no consideration of the release of radionuclides due to either industry or government-sponsored nuclear power research and development activities.

7. The potential deleterious impacts on non-human organisms due to radioactive releases from the nuclear power industry are not evaluated at all.

8. The overall levels of uncertainty associated with the amounts of radioactive releases, possible human exposure pathways and the extent of injury from chronic, low-level exposure are not adequately considered.

9. The total program, and all reasonable alternatives to its various subparts, for meeting EPA's duties to protect the public and environment from excessive radiation damage are not fully described.

10. The cost/benefit analysis is grossly incomplete, does not adequately consider the potential margin of error in cost calculations, and does not include a risk assessment.

The proposed regulations are inherently inadequate and fundamentally incomplete because, as indicated above, they were not derived from a complete analysis of the potential ill-health and adverse environmental effects of a large commercial nuclear power industry. In particular, the proposed regulations do not establish specific limits on the release of some radionuclides, e.g., radon-222 and carbon-14, and specifically exempt some nuclear facilities, e.g., mixed-oxide fuel fabricating plants, that are clearly shown in the draft statement and other reports to have a potentially greater adverse impact on the public health than the radionuclides and facilities that are covered by the proposed regulations. NRDC concludes that the proposed regulations, even in the event they are fully enforced, would inadequately protect the public and environment from the radiation damage that may be produced by the planned operations of a large nuclear power industry.

Additionally, however, the regulations are seriously defective because they are vague, too easily permit deviations from numerical standards, do not provide for adequate supervision and enforcement by EPA,[3a/] and do not provide for sufficient public notification of the extent of the nuclear power industry's compliance with the regulations. Thus, the proposed action fails by a large margin to achieve its major purpose of assuring . . . adequate radiation protection of public health and the environment." (p. 15)

In conclusion, we generally support the adoption of the Environmental Radiation Dose Commitment concept as a proper, stricter standard for protecting public health and the environment.

[3a/] The importance of EPA supervising NRC's enforcement of the proposed regulations is underscored by the recent preliminary finding of discharges from uranium mines and mills in New Mexico that exceed the maximum permissible limits established both at 10 C.F.R. Part 20 and proposed by EPA under the Safe Drinking Water Act (40 Fed. Reg. 34324, August 14, 1975). See, Rouse and Hatheway, National Field Investigations Center - Denver, EPA, "Preliminary Report on New Mexico Uranium Mine and Mill Survey, Grants, Mineral Belt, New Mexico," June 2, 1975.

We also support EPA's proposed establishment of lower permissible levels of radiation exposure and the setting of maximum total releases of krypton-85, iodine-129 and alpha-emitting transuranic radionuclides. NRDC agrees with EPA's judgment that currently permissible limits on radiation exposure are "unnecessarily high." (p. 13)

However, in order to correct the serious deficiencies outlined above, NRDC strongly urges EPA (1) to adopt modified regulations that will more adequately protect the public and the environment from the cumulative effects of releases of radioactive materials, and (2) to issue a comprehensive environmental impact statement (a) that more fully considers the potential long-term, cumulative effects of radioactive pollutants in the environment, (b) that clearly describes EPA's overall programmatic effort to fulfill its responsibilities to protect the environment and public from excessive radiation damage, and (c) that devotes itself to the regulation of, rather than the promotion of, the large-scale development of nuclear power.

Finally, NRDC again requests prompt, affirmative action on its petition seeking lower permissible levels of human exposure to "hot particles" of plutonium and other alpha-emitting radionuclides.[4/] Eighteen months have passed since the original petition was submitted; and still, six months after submission of NRDC's supplemental statement on EPA's public hearings,[5/] EPA has not conducted the needed adjudicatory hearing or ruled on the petition. Furthermore, the draft statement does not, as it should, discuss either NRDC's petition or the special hazards posed by plutonium. Such a discussion is particularly important because the detailed analysis in other EPA documents,[6/] which provide the technical bases for the proposed standards, do not themselves consider the hot particle problem or other recent analyses of the hazards of plutonium when it is not in the form of hot particles.[7/]

[4/] NRDC, "Petition to Amend Radiation Protection Standards As They Apply To Hot Particles," Submitted to EPA on February 14, 1974.

[5/] Tamplin and Cochran, "NRDC Supplemental Submission to the Environmental Protection Agency Public Hearings on Plutonium and the Transuranium Elements," February 24, 1975.

[6/] See, EPA, Environmental Radiation Dose Commitment: An Application To The Nuclear Power Industry, EPA-520/4-73-002, pp. D-8 to D-10 (February 1974); and Environmental Analysis of the Uranium Fuel Cycle, Part III-Nuclear Fuel Reprocessing, EPA-520/9-73-003-D, pp. C-10 to C-11 and C-21 to C-23 (October 1973).

[7/] See, for instance, Karl Z. Morgan, "Suggested Reduction of Permissible Exposure to Plutonium and Other Transuranium Elements," Accepted for publication in the American Industrial Hygiene Journal; John W. Gofman, "The Cancer Hazard From Inhaled Plutonium," CNR Report 1975-1-R, May 14, 1975; Edward A. Martell, "Basic Considerations in the Assessment of the Cancer Risks and Standards for Internal Alpha Emitters," Presented at the EPA Public Hearing on Plutonium and the Transuranium Elements, January 10, 1975.

II

THE DISCUSSION OF POSSIBLE ENVIRONMENTAL AND HEALTH EFFECTS IN THE DRAFT ENVIRONMENTAL IMPACT STATEMENT IS TOO NARROW, INCOMPLETE AND DOES NOT ADEQUATELY CONSIDER CUMULATIVE EFFECTS.

The Environmental Portection Agency has too narrowly focused the draft statement. The result is a significant underestimate of the potential long-term human ill health and adverse environmental effects resulting from releases of radionuclides from nuclear power plants and their supporting facilities. Indeed, we find the omissions in this draft's analysis to be inconsistent even with EPA's own intention to conduct ". . . as complete an assessment . . . as possible." (p. 19)

The stated purpose of the proposed administrative action to establish new radiation protection regulations is ". . . to insure that the anticipated major expansion of nuclear power takes place with assurance of adequate radiation protection of public health and the environment." (p. 75). In order to achieve this goal EPA must, first, conduct a thorough analysis of all potentially significant radiation sources associated with the generation of electricity at nuclear power plants, and, second, promulgate and enforce appropriate standards to protect the public and environment from unduly harmful levels of radiation from these sources.

This draft statement by EPA must provide the analysis supporting the proposed regulations. Furthermore, the statement

must also consider those potentially significant radiation sources from the nuclear power industry that EPA has not attempted to control at this time. In particular, the scope of EPA's analysis cannot properly be constrained simply because EPA currently believes that it does not have authority to regulate some radiation sources.[8/]

Unfortunately, the statement's failure to consider carefully all potentially significant sources of radioactive contaminants and radiation in the uranium fuel cycle is made more serious by the draft statement's representation, in several prominent places, that the analysis in fact is comprehensive. For instance, in the "Introduction," the draft statement proclaims that ". . . the Agency has made a comprehensive assessment of planned releases of radioactive materials associated with nuclear power generation . . . ." (p. 1, emphasis added) And, in the discussion of alternative methodologies for radiation protection, the draft statement endorses the environmental radiation dose concept because ". . . it provides an assessment of the potential public health impact of the entire industry." (p. 25, emphasis added) This is a seriously misleading representation in light of the incompleteness of the statement's analysis and the serious deficiencies in the regulations.

[8/] The Guidelines on the Preparation of Environmental Impact Statements (40 C.F.R. Part 1500) by the Council on Environmental Quality (CEQ) and court decisions under NEPA are clear on this point. See, e.g., Natural Resources Defense Council v. Morton, 458 F.2d 827, 835 (D.C. Cir. 1971).

Furthermore, the importance of comprehensiveness in the statement's analysis is underlined by EPA's stated, but in our opinion unfounded,[9] belief ". . . that national needs for electric power cannot be met without a large increase in the fraction of electric power produced by nuclear energy, given the present lack of availability of alternative sources, at least within the next few decades." (p. 9, footnote deleted) As we stated above, such a broad sweeping assertion about nuclear power is wholly inappropriate in this draft statement.[10] In any event, the deficiencies in the draft statement make such an assertion unjustified therein.

Regarding the cumulative adverse effects on public health and environmental quality, the major gaps in the analysis contained in the draft statement are: (1) the failure to consider radioactive emissions from (a) waste disposal sites (including mill tailings piles), (b) facilities undergoing decommissioning, (c) uranium mines, and (d) mixed-oxide fuel fabrication plants; (2) the neglect of the ill-health effects on future members of the general public due to gonadal and fetal exposures of nuclear workers; (3) the omission of an assessment of the possible total magnitude of "unplanned" releases; (4) the lack of an evaluation of the impact of some potentially significant radionuclides, e.g., radon and its decay products, strontium-90, cesium-137; and (5) the arbitrary neglect of the effects of long-lived radionuclides, e.g., carbon-14, beyond 100 years following their release to the environment. Each of these points is discussed further below.

A. The Entire Uranium Fuel Cycle Must Be Considered.

Clearly, in order for EPA to develop an effective set of standards for adequately protecting the public and environment from radiation resulting from the generation of electricity at nuclear power plants, consideration of all potentially significant sources of radiation within the entire fuel cycle must be included in the draft statement. This is true even if: (1) EPA believes there is insufficient information available about some potential radiation sources, e.g., radon from mill tailings piles, to promulgate standards now;11/ (2) EPA does not believe that it has authority to regulate some potential sources, e.g., occupational exposure sources; or (3) EPA, for another reason, has determined that the proposed radiation protection standards will not apply to some potentially important radiation sources, e.g., emissions from mixed-oxide fuel fabrication plants, at this time. Unfortunately, to the contrary, EPA, using all three of the above inadequate justifications, has decided to exclude improperly several potentially important aspects of the uranium fuel cycle.

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[9] See, for instance, Cochran, Speth and Tamplin, "A Poor Buy," Environment 17 (No. 4), pp. 18-19 (June 1975); The American Institute of Architects, "A Nation of Energy Efficient Buildings by 1990," p. 3; and Ford Foundation Energy Policy Project, A Time to Choose, Ballinger Publishing Co., p. 223 (1974).

[10] Even if the analysis of environmental and public health effects due to releases of radionuclides were complete, we believe that EPA's evaluation of the overall advisability or necessity of using nuclear power should not be a part of an impact assessment related to the promulgation of new environmental radiation protection standards. The nuclear issue is a very complicated one involving consideration of, for instance, civil liberties that will be reduced to protect plutonium from theft, the possibilities of catastrophic accidents, the reliability and overall economics of nuclear power plants, and the feasibility of permanently disposing of long-lived wastes, to name only some. If EPA wants to urge the rapid development of nuclear power, it should do so within another context that allows detailed evaluation of all the relevant issues. To NRDC's knowledge, EPA has never completed such an analysis. Certainly, no comprehensive EPA analysis was referenced in the draft statement.

1. Uranium Mining -- Without adequate explanation, one type of facility not evaluated in the draft statement as a potential radiation source is the uranium mine. (See, e.g., pp. 8, 30, 141.) Perhaps, EPA believes that it has no responsibility for radioactive releases from uranium mines; or EPA judges that, in any event, the radiological impact of uranium mining on the general public is insignificant. Neither belief, even if correct, would be sufficient for not at least generally discussing the potential radiological consequences of uranium mining and the reasons for omitting them from coverage by the proposed regulations. Additionally, since under Reorganization Plan No. 3, EPA was delegated the authority of the former Federal Radiation Council to issue guidance for permissible occupational exposure to workers, EPA's intentions with respect to issuing additional guidance for the protection of uranium miners should be explicitly discussed in the final statement, in any event.

There is information suggesting that the radiological impact of uranium mining on the general public is not always negligible. For instance, substantial quanitites of radon-222, radium-226, and thorium-230 are spewed into the atmosphere from Rio Algom's uranium mine near La Sal, Utah. Residents at the nearby Redd Ranch receive 42 mrem/year to bone, and 11 mrem/year to lung, evidently as a result of the combined releases from the mine and the nearby mill. Members of the public at the unfenced boundaries of the mill site could receive 200 mrem/year to bone and 74 mrem/year to lung.12/ These radiation exposure levels are well above the proposed standards for protection of members of the general public. An appreciable fraction of these potential doses is evidently due to releases from the ventilation shaft of the mine. In general, we are concerned that, unless access to mining sites is more strictly controlled than at Rio Algom's mine, members of the public could receive significant doses of radiation due to exposure to radon gases expelled through ventilation shafts at underground mines.

11/ Two purposes would be served by this type of assessment. First, uncertainties in the full magnitude of deleterious impacts of nuclear power would be indicated. This is important information for consideration by decision-makers considering commitments to nuclear power. Second, EPA and other agencies would have a better assessment of what research and analysis should be sponsored in order to be better able to adopt comprehensive radiation protection standards.

12/ U.S. Atomic Energy Commission, Draft Detailed Statement On The Environmental Considerations . . . Related To The Proposed Issuance Of A License To The Rio Algom Corporation For The Humeca Uranium Mill, Docket No. 40-8084, pp. 35-37 (December 1972).

Apparently, due to the leaching of radionuclides by water invading underground uranium mines in New Mexico, EPA has recently discovered dangerously high levels of radioactivity in drinking water. A preliminary EPA report stated, for instance, that the concentrations of gross alpha and radium-226 in the drinking water supply near one mine "grossly exceed the proposed standards and may pose a health hazard to employees and their families."[13/]

2. Radioactive Waste Management Facilities -- There is no clear explanation in the draft statement for not discussing radioactive waste storage and disposal facilities and including them for coverage by the proposed regulations. (See p. 94.) The absence of detailed consideration of waste management is particularly puzzling in light of the admission that the waste management issue ". . . is basic to the environmental viability of nuclear power . . . ." (p. 94)

However, two reasons for this limited approach are suggested in the statement. First, perhaps EPA simply has not yet completed an analysis of possible future exposure pathways from waste storage or burial sites. (p. 94) Although this may be true and, if so, would be a very practical excuse, it is not a reasonable explanation from the Agency mandated by Congress to protect the environment and public health.

[13/] J.V. Rouse and J.L. Hatheway, National Field Investigations Center - Denver, EPA, "Preliminary Report on New Mexico Uranium Mine and Mill Survey, Grants, Mineral Belt, New Mexico," p. 9 (June 2, 1975).

The second possible reason, while more explicitly stated, is no more valid: ". . . [waste management] has been treated as separable from the question of reasonable levels of planned effluents because the wastes generated by effluent control systems represent a miniscule addition to the total waste management problems of the industry." (p. 95) In other words, the draft statement suggests that, because its proposed regulations will not themselves result in the generation of large amounts of waste in comparison with what the nuclear power industry would generate anyway, EPA has no obligation at this time to review the issue. This is an absurd explanation on its face. Indeed, if EPA restricted its entire analysis on the same basis, there would be little substance to discuss in the impact statement. For instance, will EPA's proposed regulations result in the handling of additional amounts of plutonium at reprocessing plants that will have to be prevented from entering the environment?

There is, in fact, a great need for EPA's full consideration of waste management issues in this draft statement and coverage of waste storage and disposal facilities by the proposed regulations, for, unfortunately, there is a substantial long-term threat posed by current waste storage and disposal operations. The threat is made more real by the lack of adequate plans for the safe management of long-lived wastes. Furthermore, there already have been significant releases of radionuclides into the general environment due to the improper handling of uranium mill tailings and low-level wastes. Thus, at least so far, mill tailings and low-level wastes have not been so much stored, as disposed.

a. Low-level waste burial -- Current practice is to permit the burial of low-level wastes, including transuranic wastes, in shallow earthen trenches. Apparently, containers are not designed to retain these wastes for the long periods of time required for the radioactivity to decay to innocuous levels. EPA has previously expressed concern about the lack of detailed documentation about the possibility that the long-lived components of low-level waste may escape into the general environment, as follows:

> "EPA has reviewed the engineering and hydrogeological reports prepared for the licensing of the existing commercial burial grounds. In our view these were preliminary reports suitable for identifying potentially acceptable burial sites. The AEC should present or directly reference in the final statement the results of any studies which have been conducted at these commercial burial sites, subsequent to the beginning of burial operations, which corroborate or validate the conclusions reached in the original evaluation and which demonstrate that '. . . after burial the radioactive material in the waste will be retained at the site and not migrate from the vicinity of the burial location,' and which show that, 'to date, there has been no indication of migration of radioactivity from any commercial burial site.'"
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> "Monitoring data or other evidence which confirms that the plutonium now buried has remained immobile at the place of burial and does not constitute a threat to man or the biosphere should also be submitted or directly referenced. Due to the large volumes and activities of waste which are destined for disposal in these land burial sites, such validation studies are vital to assess their current and potential environment impact."14/

Additionally, a recent study by the U.S. Geological Survey suggests that a complete safety analysis has not yet been completed for any commercial low-level waste burial site, and further, that at least some of the sites would not qualify as safe by the strict criteria set forth.15/

The amounts of alpha-emitting wastes16/ that may be buried in shallow trenches are large in comparison with the amounts of alpha-emitting radionuclides that could be discharged to the general environment under the proposed regulations. For instance, in the year 1980, the projected production of alpha wastes will contain about 2 million curies of alpha-emitting radionuclides. Since the average nuclear generating

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14/ EPA, Comments (D-AEC-A00107-00) on Management of Commercial High-Level and Transuranium-Contaminated Radioactive Waste (WASH-1539), p. 11 (November 1974). See, also, EPA's Comments on the Proposed Final Environmental Statement on the Liquid Metal Fast Breeder Reactor Program, April 1975, which indicate that the requested copies of documentation demonstrating the safety of the low-level waste burial sites have not been provided to date.

15/ Papadopulos and Winograd, U.S. Geological Survey, "Storage of Low-Level Radioactive Wastes in the Ground; Hydrogeologic and Hydrochemical Factors with an Appendix on The Maxey Flats Kentucky Radioactive Waste Storage Site: Current Knowledge and Data Needs for a Quantitative Hydrogeologic Evaluation," Open-File Report 74-344 (EPA-520/3-74-009), 1974.

16/ As EPA has recognized elsewhere, categories of radioactive wastes are not well-defined. Here, alpha wastes mean only the "alpha wastes" identified in Blomeke, Kee, Nichols, Projections Of Radioactive Wastes To Be Generated By The U.S. Nuclear Power Industry, ORNL-TM-3965, February 1974. The smaller quantities of alpha-emitting radionuclides in "alpha-beta-gamma wastes" are ignored. The bulk of the alpha wastes will be generated in plutonium recycle facilities, specifically fuel preparation and fabrication facilities.

capacity for the year will be about 114 GWe, there will be about 17,500 curies of alpha-emitting transuranics per average installed GWe-year in 1980.[17/] This is 35 million times more than is permitted for release to the general environment under the proposed regulations.

Furthermore, the amounts of alpha-emitting radionuclides in the low-level alpha wastes are significant in comparison with the alpha-emitting component of high-level wastes. For instance, by one estimate "[a]bout 45% of the initial alpha radioactivity is in high level wastes, 45% is in alpha wastes, and 10% is in ore tailings."[18/] This means that ". . . the long-term toxicity of low-level wastes contaminated with actinides may equal or exceed that of high-level wastes."[19/]

Another scientist estimates that, ". . . the amount of plutonium lost to the low-level wastes in reprocessing, fuel preparation and fabrication operations is greater than the amount of plutonium associated with the high-level fission-product wastes. . . . The amounts of plutonium in all of these wastes

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[17/] Of course, this is an underestimate since only a portion of the electricity generated at the nuclear power plants is attributable to the fissile plutonium contained in the fuel.

[18/] Jansen, Schneider, and Hammond, Battelle Pacific Northwest Laboratories, "A Conceptual System for Handling Alpha-bearing Wastes," BNWL-SA-5001, October 1974.

[19/] Battelle Pacific Northwest Laboratories, Program for the Management of Hazardous Wastes for the Environmental Protection Agency, Office of Solid Waste Management Programs, Final Report, p. 152 (July 1973).

are significant, and it is important that careful attention be given to a waste management program which insures careful control of all of these wastes."[20/]

In September 1974, the AEC, recognizing the potential long-term hazard posed by the low-level wastes, proposed a new regulation requiring federal custody of wastes containing more than a very low concentration (10 nanocuries per gram) of transuranic radionuclides.[21/] However, following the transfer of the AEC's responsibilities to ERDA and NRC, and the ERDA Administrator's subsequent decision to withdraw the environmental impact statement considering the proposed regulation and to prepare a new statement,[22/] the fate of the proposed regulation is uncertain.[23/] Thus, for the foreseeable future, transuranic wastes will continue to be buried in shallow earthen trenches at six commercial disposal sites.

Already there are measurements of off-site radioactivity that suggest radionuclides in the low-level wastes are migrating

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[20/] T.H. Pigford, "Radioactivity In Plutonium, Americium and Curium In Nuclear Reactor Fuel" (A Study for the Energy Policy Project of The Ford Foundation), p. 36 (June 1974).

[21/] 39 Fed. Reg. 32921, September 12, 1974.

[22/] See, Letter dated April 19, 1975, from Robert C. Seamans, Jr. to the Honorable John O. Pastore, Chairman, Joint Committee on Atomic Energy, Congress of the United States.

[23/] Letter, dated August 20, 1975, from Donald A. Nussbaumer, Assistant Director for Materials Agreements and Transporation, Division of Materials and Fuel Cycle Facility Licensing, NRC, to R.A. Kreiss and T.R. Lash, NRDC.

away from the burial trenches. For instance, last year a multi-agency state study found that: "The radioactive waste disposal site at Maxey Flats, Kentucky is contributing radioactivity to the environment. . . Man-made radionuclides measured in certain individual samples collected in the unrestricted environment identified Tritium, Cobalt 60, Strontium 89 and 90, Cesium 134 and 137, and Plutonium 238 and 239."[24] Similarly, due to the flooding of burial trenches at the West Valley, New York low-level waste disposal facility, radionuclides have moved off-site into adjacent waterways.[25]

Thus, after only about a dozen years of operation low-level wastes, containing significant quantities of very long-lived radionuclides, are contributing to the general environmental burden of radioactive materials. EPA's draft statement and proposed regulations should analyze and consider this potential radiation source thoroughly.

b. High-level waste disposal -- Currently, no high-level wastes are produced at commercial facilities, although about 600,000 gallons of neutralized liquid is stored at West Valley, New York, from previous reprocessing operations. Since both ERDA and NRC are reviewing plans for the management of commercial high-level wastes, now is the appropriate time to establish regulations governing potential discharges of radioactive materials from high-level waste management facilities, before hard-to-reverse decisions are finalized. These limitations on the release of radionuclides could then be incorporated into the NRC's and ERDA's criteria for an acceptable design for licensing and operating purposes, respectively.

c. Uranium mill tailings -- Apparently, mill tailings piles were excluded from consideration in the draft statement on the vague grounds that:

> "There exists considerable uncertainty about the public health impact of existing levels of radon in the atmosphere, as well as over the best method for management of new sources of radon created by man's activities, which remove this naturally occurring material and its precursors from beneath the earth's protective crust." (pp. 133, 134)

The draft statement further alleges, without elaboration, ". . . that the problems associated with radon emissions are sufficiently different from those of other radioactive materials associated with the fuel cycle to warrant separate consideration. . ." (p. 134).

These two cursory assertions are not persuasive for at least three reasons. First, about two years ago, EPA itself conducted an assessment of the possible long-term radiological effects of radon gas emanating from uranium mill tailings piles.[26/] This earlier EPA analysis seems to be about as thorough as the analyses of other aspects of the uranium fuel cycle, that form the technical basis for this draft statement and proposed regulations. Second, there has been no showing that the degree of uncertainty concerning the actual effects of radon released from tailing piles is significantly greater than in the case of other radioactive releases, e.g., carbon-14 (p. 68), that are evaluated in the draft statement.[27/] And, third, while there is no general agreement on the "best method for management" of radon from mill tailings, this situation is certainly not unique to radon effluents. For instance, options for controlling releases of krypton are only at the research, development, and demonstration stages,[28/] yet this situation did not prevent EPA from analyzing the radiological impacts of, and proposing appropriate limitations on releases of, krypton gas. To compensate for the uncertainty in their availability, the Agency has explicitly stated that if at least one of these control technologies does not prove out, the proposed regulations will be re-evaluated with that in mind. (p. 36) A similar approach may be appropriate in regard to radon releases from uranium mill tailings piles.[29/]

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[24] Kentucky Department of Human Resources, Bureau for Health Services, Office of Consumer Health Protection, Radiation and Product Safety Branch, Project Report, "Six Month Study of Radiation Concentrations And Transport Mechanisms At The Maxey Flats Area Of Fleming County, Kentucky," p. 17 (December 1974).

[25] See, New York State Department of Environmental Conservation, NYS Environment, April 1 and July 1975; and Nuclear News, p. 64 (May 1975).

Furthermore, methodologies for limiting the emanation of radon from uranium tailings are not technologically complicated or speculative. In a recent report (that may have been known to EPA in draft form well over a year ago), scientists at the Oak Ridge National Laboratory identify, and discuss in terms of cost and degree of practicality, several procedures for virtually eliminating the escape of radon from tailings into the general environment.[30/] Indeed, the effectiveness of a thick (e.g., 20 foot) layer of earth in preventing the emanation of radon from tailings piles has been known for years.[31/] The draft statement should have assessed the desirability of several means to control releases of radon.

[26/] EPA, Environmental Analysis of the Uranium Fuel Cycle, Part I - The Fuel Supply, EPA-520/9-73-003-B, pp. 51-74 (October 1973).

[27/] "[D]ue to very large uncertainties concerning . . . environmental behavior [of plutonium and other transuranics] over long periods of time, as well as a lack of definitive information concerning the relationship between exposure to these materials and health effects, the limits of this potential impact cannot be more than roughly estimated." (pp. 129-130)

[28/] EPA, Environmental Analysis of the Uranium Fuel Cycle, Part III - Nuclear Fuel Reprocessing, EPA-52-/9-73-003-D, pp. B-14, B-16 (October 1973).

[29/] Naturally, the draft statement should also consider the magnitude and effects of releases of other radionuclides, e.g., radium-226, from tailings piles.

[30/] Sears et al., Correlation of Radioactive Waste Treatment Costs and the Environmental Impact of Waste Effluents in the Nuclear Fuel Cycle for Use in Establishing "as Low as Practicable" Guides - Milling of Uranium Ores, ORNL-TM-4903, Vol. 1 (May 1975).

[31/] Schroeder and Evans, "Distribution of Radon and Radon Fluxes within Multilayered Systems," M.I.T. Radioactivity Center Annual Progress Report on Radium and Mesothorium Poisoning and Dosimetry and Instrumentation Techniques in Applied Radioactivity, MIT-952-4, p. 316 (May 1967.

Thus, there appears not to be a good reason for the draft statement's failure to consider radon gas escaping from mill tailings. On the other hand, the large number of human deaths (ca. 400 per gigawatt-year) potentially caused by simply leaving mill tailings on the earth's surface with little, if any covering,[32] is ample justification for a full discussion of the environmental and health hazards posed by the tailings.[33]

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[32] Generally, if tailings piles are "stabilized" at all, less than two feet of earth is placed on top. (See, AEC, Final Environmental Statement related to operation of Shirley Basin Uranium Mill, Utah International, Inc., Docket No. 40-6622, p. IV-20 (December 1974).) Even if this covering remained intact for the thousands of years that the critical radionuclides remain potentially hazardous, such a thin layer is inadequate to reduce significantly the amount of radon released. See preceeding footnote.

[33] The total number of human deaths resulting from the emanation of radon gas from mill tailings piles has recently been estimated using EPA's environmental radiation dose commitment concept, to be greater than the human deaths caused by coal-fired power plants. See, Pohl, Cornell University, "Nuclear Energy: Health Effects of Thorium-230," submitted to Technology Review; and omey, "The Legacy of Uranium Tailings," The Bulletin of Atomic ientists, pp. 42-45 (September 1975).

3. Plutonium Recycle -- Evidently, the basis for excluding consideration of plutonium recycle in the draft statement is the fact that, "The liquid metal fast breeder reactor, which would make possible the extensive production and utilization of plutonium fuel . . . is not expected to be commercially available before the late 1980's, at the earliest." (p. 3) Plutonium recycle, unfortunately, may not be that remote, for, as is recognized in the draft statement, "substantial quantities of plutonium-239 are produced by light-water-cooled reactors" (p. 3) and "some commercial use of recycled plutonium in light-water-cooled reactors is proposed for the near future." (p. 4)

In fact, again as is admitted in the draft statement, virtually the sole purpose of reprocessing spent fuel from light-water-cooled reactors, an activity that is discussed in the draft statement, is ". . . to recover substantial quantities of unused uranium and reactor-produced plutonium for future reuse." (p. 4)[34] For this reason, there is as sound a basis for fully considering the use of the recovered plutonium in fuel for light-water-cooled power reactors as there is for assessing the potential radiological effects of spent fuel reprocessing.

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[34] The regulatory division of the former U.S. Atomic Energy Commission (AEC) has stated that reprocessing of spent fuel from light-water-cooled reactors would not be economically justified if plutonium cannot be recycled. See, AEC, Draft Generic Environmental Statement Mixed Oxide Fuel, WASH-1327, Volume 1, p. S-11 (August 1974). Hereinafter, "DRAFT GESMO".

More generally, there are two deficiencies with EPA's analysis that are particularly troublesome with regard to plutonium recycle activities: (1) failure to consider the magnitude of uncertainties in the projected levels of control of radioactive releases; and (2) failure to assess the impacts of abnormal, unplanned or unusual operations. These matters are crucially important because "the actinides are, in general, very long-lived materials and their eventual total impact over many centuries may be many times that experienced during the first 100 years following release."35/

EPA, in the draft statement, assumed that only one-billionth (10^{-9}) of the alpha-emitting transuranic radionuclide inventory would be released to the general environment if there were no plutonium recycle. However, this assumption grossly underestimates the likely health effects for the case of plutonium recycle. As EPA has stated, "when allowance is made for inclusion of cumulative releases from the variety of fuel processing operations as well as transportation and handling throughout the entire fuel cycle, the fractioned loss of plutonium and the actinides to the environment for the entire fuel cycle must be assumed to be greater than that from a single operation. In this context "*the fractional release of the actinides is not realistically expected to exceed 10^{-7} of the total amount handled in any given year*."36/ Thus, the

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35/ EPA, *Environmental Radiation Dose Commitment: An Application To The Nuclear Power Industry*, EPA-520/4-73-002, p. 23 (February 1974).

36/ *Id.* at p. 16 (emphasis added).

draft statement seems to underestimate the actual health effects due to the release of long-lived transuranic radionuclides by at least a factor of 100.

For the purposes of this draft statement and proposed rulemaking, EPA implies that the overall impact of radiation doses due to unplanned or unusual releases will be "minimal". (p. 137) No studies are cited to substantiate this claim, however. On the other hand, over two years ago an EPA official stated that

> "[m]ore information is critically required for unknown or inadvertent releases from facilities processing plutonium. Currently, the AEC is unable to account for one part in 10^{3-4} of this material in such facilities. Environmental releases must be maintained to less than one part in 10^{8-9}. Careful studies of some representative facilities will be made."37/

The final statement should present the results of these "careful studies" as evidence that unplanned or abnormal releases of transuranic radionuclides will not far exceed the limits for "normal operations" contained in the proposed regulations.

Unfortunately, the sad history of the handling of plutonium strongly suggests that even the 10^{-7} fractional release estimate is too low. The safety record at the Nuclear Fuel Services' reprocessing plant at West Valley, New York; the Kerr-McGee fuel fabrication plant at Crescent, Oklahoma; and the Nuclear Materials and Equipment Corporation fuel

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37/ EPA, "Environmental Radiation Exposure Advisory Committee, Minutes of Tenth Meeting, March 20-21, 1973," p. 9.

fabrication plant at Apollo, Pennsylvania are discussed by Robert Gillette in a Science article, "Plutonium (I): Questions of Health in a New Industry". Gillette reports:

> "The safety record compiled by the three main commercial processors [NFS (West Valley), Kerr McGee, and NUMEC] is subject to differing interpretations, but from a review of inspection reports made public by the AEC, it is hard to see that any of them is quite in command of the technology.
>
> The record reveals a dismal repetition of leaks in glove boxes; of inoperative radiation monitors; of employees who failed to follow instructions; of managers accused by the AEC of ineptness and failing to provide safety supervision or training to employees; of numerous violations of federal regulations and license requirements; of plutonium spills tracked through corridors, and, in half a dozen cases, beyond plant boundaries to automobiles, homes, at least one restaurant, and in one instance to a county sheriff's office in New York."38/

Also, Gulf United's Plutonium Facility at Pawling, New York, was permanently closed following a chemical explosion, a fire and a second explosion on December 21, 1972. This accident resulted in extensive plutonium contamination within the facility, a breach in the exhaust system in the plutonium handling room area, and the release of an undetermined quantity of plutonium from the building through blown out windows. According to Gulf United's analysis of the accident,

> "[a]t the time of the explosion, one employee was standing directly in front of a large window in the north wall of the facility. He observed that the window was intact when he left the building. It was subsequently found that every pane in this window had been blown out or broken, which suggests that a second explosion took place, presumably when all of the employees were at the remote assembly building 0.9 mile away, and the plutonium facility itself was unattended. It is evident that a fire followed the initial explosion and it is plausible that this fire caused one of the bottles of flammable solvent to gradually heat up and rupture, dispersing its contents in air to form another explosive mixture. That no one heard a second explosion is understandable if it occurred when all of the personnel were in the remote assembly building."39/

Following the explosions and fire at Gulf United's facility, AEC inspections at this facility between December 21, 1972 and October 31, 1973 identified the following violations and safety items:

> "A. Violations
>
> 1. Failure to continuously evaluate the stack effluent."40/ [Gulf United failed to make such surveys as were necessary to assure compliance with 10 C.F.R. 20.106, "Concentrations in effluents to unrestricted areas."]
>
> B. Safety Items
>
> "Accepted radiological and nuclear safety practices dictate that: (1) procedures, facilities, and equipment are adequate for effective control during emergencies; and (2) that emergency drills be routinely conducted.

38/ Gillette, Robert, "Plutonium (I): Questions of Health in a New Industry," Science 185 (20 September 1974), pp. 1029-1030.

39/ Gulf United Nuclear Fuels Corporation, "Report of Incident at Gulf United's Plutonium Facility at Pawling, New York," Elmsford, New York (January 19, 1973), p. 11.

40/ U.S. AEC, Directorate of Regulatory Operations, Region I. "Inspection Report No.: 70-903/72-02," special inspection conducted by Mr. Lorenz on December 21, 22, 26, 27 and 29, 1972 of activities authorized by AEC License No. SNM-871 at "Licensee: Gulf United Nuclear Fuels Corporation, Grasslands Road, Elmsford, New York," Docket No. 70-903.

a. Contrary to the above, your [Gulf United's] emergency alarm signal system was inadequate in that the alarm was not audible to all persons at the main site location.

b. Contrary to the above, your [Gulf United's] Emergency Policy and Procedures were not maintained by the current emergency call list. . . .

c. Contrary to the above, and as prescribed in your [Gulf United's] Emergency Policy and Procedures, no annual emergency training drill was conducted in 1972, and the formal training program for personnel was not scheduled.

d. Contrary to the above, your [Gulf United's] remote assembly building was inadequate for personnel decontamination in that drain water from shower and wash facilities could not be collected and analyzed prior to release.

e. Contrary to the above, your [Gulf United's] procedures did not provide that proper survey instruments accompany injured contaminated personnel when referred for medical treatment."41/

A subsequent AEC inspection in June 1973, during cleanup operations identified the following additional violations:

"1. Failure to have waste drums properly stored inside building. The drums of unrecoverable waste were stored outside of any buildings. . . .

2. Failure to have a contamination survey station at the exit of the Plutonium Laboratory and to require personnel to perform surveys prior to leaving the contamination zone. . . .

41/ Letter from James P. O'Reilly, Director, U.S. AEC Directorate of Regulatory Operations, Region I, to Gulf United Nuclear Fuels Corporation in reference to Docket No. 70-903, dated May 17, 1973, Enclosure No. 2, Description of Safety Items.

3. Failure to either provide a criticality monitoring device for material stored in the Plutonium Laboratory vault or to analyze whether or not a criticality monitoring device located about 15 feet away with about 3 feet of intervening concrete would provide the required radiation detection."42/

Gulf United is not unique in its failure to follow regulations. NUMEC was recently fined $13,720 for a sixteen count violation of AEC regulations ranging from failing to follow radiation monitoring to failure to comply with certain safeguards requirements.43/ One of these pertained to the failure to install an adequate fire alarm system, and another pertained to the storage of flammable materials in a glove box. Similarly, NFS Erwin facility was recently cited for five licensing violations all related to health and safety.44/ These cases represent a small sample of the total AEC licensing violations, and the cases where fines have been levied, such as NUMEC, are rare. On August 25, 1974, the New York Times reported,

> "For the year ending June 30, for example, commission inspectors found a total of 3,333 violations in 1,288 of the 3,047 installations they examined.

42/ U.S. AEC, Directorate of Regulatory Operations, Region I. "Inspection Report No. 70-903/73-02," routine-unannounced inspection conducted by Mr. Kinney on June 28-29, 1973 of activities authorized by AEC License No. 871 at "Licensee: Gulf United Nuclear Fuels Corporation, Grassland Road, Elmsford, New York," Docket No. 70-903.

43/ AEC News Releases, Vol. V (August 14, 1974), p. 4.

44/ Letter from N. C. Moseley, Director, U.S. AEC Directorate of Regulatory Operations, Region II, to Mr. William Manser, Jr., Plant Manager, Nuclear Fuel Services, Inc., Erwin, Tennessee (18 October 1974), Re: "RO:II:FJL 70-143/74-01."

> According to the commission's own definition, 98 of these charges were considered to be the most serious of three categories of violation. By this definition, they posed a health threat in that they caused or were likely to cause radiation exposures to employees or the public in excess of permitted limits, involved the release of radioactive materials in the environment beyond permitted limits or were a security threat.
>
> During the year, however, the commission imposed punishments on only eight occasions. It revoked the license of two small companies and levied civil penalties against six others totaling $37,000."

The same article quotes Anthony Mazzocchi, legislative director for the Oil Chemical and Atomic Workers,

> "The fact that the A.E.C. finds violations in one-third of the installations it inspects is clear evidence the regulations do not work,. . ."

Mazzocchi also noted that,

> "he was aware of a number of situations where inspectors had found repeated violations but had taken no action.
>
> He cited Nuclear Fuel Services of Erwin, Tenn., where he said there had been at least 15 separate incidents since 1969 in which more than 50 workers had been exposed to radiation above permissible limits. Despite these repeated incidents a commission spokesman confirmed Mr. Mazzocchi's statement that the agency had never suspended or revoked or otherwise penalized Nuclear Fuel Services."

Finally, we note that the violations cited by the AEC probably represent a small sample of the total. For example, the violations at the NFS Erwin facility, noted above, were discovered only after production workers requested a meeting (held August 13, 1974) with AEC to complain about unsafe working conditions at that facility, and we would hasten to add that NFS is not unique in this respect. The final statement should present data for

all plutonium handling facilities, including NFS-Erwin, Exxon and DOW-Rocky Flats, for each year of operation. Where data is not available an explanation should be given, for example, with respect to the total release from NUMEC. This table should also present data on the yearly plutonium throughput.

In sum, the full radiological consequences resulting from plutonium recycle, and their implications for limits on releases from nuclear facilities, need to be fully analyzed in the final environmental impact statement because: (1) plutonium recycle is not speculative or unlikely;45/ (2) indeed, the principal purpose of spent fuel reprocessing, which is discussed in the draft statement and covered by the proposed regulations, is to recover plutonium for reuse in nuclear fuel; (3) plutonium has a "high toxicity" and persistence that could cause a "large" cumulative impact if released to the environment (p. 129); and (4) the potential magnitude of planned and unplanned releases of plutonium and other transuranic radionuclides will be substantially increased during the fabrication of plutonium-containing fuel.46/ Thus, EPA should

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45/ See, e.g., Nucleonics Week, p. 7 (August 7, 1975) and p. 3 (July 31, 1975).

46/ Indeed, it seems that the annual planned release of alpha-emitting transuranic radionuclides due to plutonium recycle would exceed the Section 190.10(b) standard by four-fold: "The annual dispersal into the environment of 2 alpha millicuries per GWy(e) . . . may result from handling plutonium in the mixed oxide fuel cycle . . ." DRAFT GESMO, Vol. 3, p. IV J-7. In our opinion, based on the history of existing plants that have handled plutonium, the AEC's estimate of possible routine releases is grossly overly optimistic. See, Cochran and Speth, NRDC Comments on WASH-1327, General Comments, pp. 13-16, 24-26.

fully analyze in the final statement the potential radioactive releases and human radiation exposure attributable to plutonium recycle, including the operation of mixed-oxide fuel preparation and fabrication plants.

Additionally, in the final statement, EPA should clearly present the methodology and procedures that will be used to determine the amount of plutonium and other alpha-emitting radionuclides (per gigawatt-year of nuclear generation) released to the general environment due to normal and abnormal operations of all plutonium recycle facilities, including reprocessing plants and mixed-oxide fuel preparation and fabrication plants. This information needs to be presented in detail because there is reason to believe that EPA cannot, in practice, determine that its standards have been met.

4. Research and Development Facilities -- A source of radioactive emissions and radiation exposure that is not even mentioned are the research and development facilities which are necessary for the "commercialization" of nuclear power. These releases should also be counted as part of the environmental contamination caused by the nuclear power industry. The magnitude and potential effect of such releases should be presented in the final statement, and the proposed regulation should be rewritten to limit their effects in accordance with EPA's radiation protection objectives.

Furthermore, EPA should take cognizance of the possibility that large facilities, heretofore considered "commercial" facilities, may now be designated "developmental" and involve federal participation in their operation. Apparently, for instance, the large spent fuel reprocessing plant at Barnwell, South Carolina, is a candidate for conversion from a "commercial" to a "developmental" facility.[47] Thus, EPA's environmental analysis should evaluate the impact of, and possibilities of reducing, radioactive effluents from research and development facilities to the extent that they support the nuclear power industry. Furthermore, the limitations on radioactive releases in the proposed regulations should be applicable to such facilities.

In the final statement, EPA should declare whether or not it has evaluated the extent of radioactive releases and radiation exposure from both governmental and private research and development facilities, and assessed the availability of control procedures to limit releases and radiation exposures attributable to the growth of the nuclear power industry. In any event, EPA should explicitly state whether or not the proposed regulations apply to such facilities.

5. Decommissioning of Facilities -- Another potential radiation source that is too quickly dismissed from analysis in the draft statement and coverage by the regulations is the decommissioning of retired facilities. (pp. 6, 95) Certainly decommissioning procedures have not been adequately planned.[48]

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[47] See, e.g., Nucleonics Week, p. 7 (August 7, 1975).

[48] Ford Foundation Energy Policy Project, A Time To Choose, Ballinger Publishing Co., p. 210 (1974). See also, Yarbro, Harrington and Joy, Effluent Control In Fuel Reprocessing Plants, ORNL-TM-3899, pp. 14-17 (March 1974).

In light of this uncertainty about how decommissioning will be accomplished, the statement should carefully consider whether or not there is the potential in the future for genetically significant or fetal radiation exposure of workers[49/] or exposure to the general public. Furthermore, there should be a specific explanation for not including the decommissioning of facilities in the proposed standards.

The magnitude of this potential problem is, perhaps, indicated by the release of plutonium during decommissioning of Building 12, a plutonium laboratory at Los Alamos Scientific Laboratory. The annual release from that facility is estimated to have been 13 microcuries (alpha),[50/] while the release when it was torn down was about 1,400 microcuries (alpha)[51/] or about 100 times the annual release.

B. The Total Health Effects Caused By The Release Of Radionuclides Must Be Estimated For The Entire Period That The Radionuclides Remain Potentially Hazardous

The potential health effects caused by releases of radioactive materials are calculated only for 100 years following their discharge. (p. 12) However, the draft statement admits that,

> "The total significance of environmental burdens of carbon-14, iodine-129, and the long-lived transuranics, which have half-lives of 5700 years, 17 million years and from 18 to 380,000 years, respectively, cannot be quantitatively assessed, but must be assumed to be considerably greater than that anticipated during the first 100 years alone." (p. 80)

Unfortunately, the draft statement does not consider this issue, and, thereby, obscures the true dimensions of the potential ill-health effects of the nuclear power industry. Furthermore, the failure to evaluate the total, cumulative health effects distorts the cost-benefit analysis.

Consider the carbon-14 problem alone. The draft statement lists 12,000 health effects over 100 years for the carbon-14 releases through the year 2000. (p. 82) With a half-life of 5700, however, only 0.012 of the released carbon-14 has decayed by that time. At the same rate, as for the first 100 years, then, the remaining carbon-14 could cause a total of one million health effects. Similar calculations can be made for the other long-lived radionuclides.

While such calculations may overestimate the total impact of the released radionuclides, it seems prudent to use these estimates of total effects for the purposes of assessing the potential impact of the nuclear power industry and rulemaking. Naturally, the estimates can be reasonably reduced if there is evidence of a significant amount of sequestering of the radionuclides away from human exposure pathways.

[49/] As discussed below, radiation exposure of nuclear workers that can result in genetic defects or injury to fetuses must be evaluated in the final statement. Furthermore, EPA must regulate such exposures in order to protect future members of the general public.

[50/] DRAFT GESMO, p. IV D-28.

[51/] AEC, Plutonium Information Meeting Transcript, Los Alamos, N.M., p. 66 (January 4, 1974).

C. The Health Effects On Future Members Of The General Population Due To Radiation Exposure Of Nuclear Workers Should Be Assessed

During the six year period 1969 through 1974, the average person-rem per megawatt-year was about 1.3, with a range from 0.9 to 1.6.52/ An earlier study suggests that as the large nuclear power plants age, the average person-rem per plant tends to increase due to the accumulation of radioactive crud.53/ The total person-rems for individual plants needing substantial repairs can be considerably higher.54/

Assuming a projected 1,200 gigawatts of nuclear capacity by the year 2000 (p. 9), then the total annual occupational exposure at these plants could be about 1.6×10^6 person-rems. Since EPA estimates that the general world population exposure due to the current operation of the American nuclear power industry is 0.1 person-rems per megawatt (p. 103), the expectation in the year 2000 is for a total of 1.2×10^5 person-rems of exposure directly to the general world population. In other words, the total occupational exposure is 13 times the general population exposure.

52/ NRC, "Occupational Radiation Exposure At Light Water Cooled Power Reactors, 1969-1974," NUREG-75/032, p. 7 (June 1975).

53/ Pelletier, et al., "Compilation and Analysis of Data on Occupational Radiation Exposure Experienced at Operating Nuclear Power Plants," prepared for Atomic Industrial Forum, Inc., pp. 11-16 (September 1974).

54/ For instance, during a few months to repair Indian Point-1, a 265 MWe plant, the total exposure was 3,500 person-rem. Nuclear News 18, p. 56 (September 1975).

This is a significant point because the occupational exposure affects the world's genetic pool just as though the radiation dose were given directly to the general population without the intermediacy of the occupationally exposed. Thus, EPA errs when it states that "a standard of 1 person-rem per MW(e) would have no impact whatsoever on either population exposures due to short-lived radionuclides or on local or worldwide environmental buildup of long-lived radionuclides." (p. 103) The final statement should reevaluate the advantages of alternatives taking into consideration the genetically significant dose received by nuclear workers.

The genetically significant dose received by nuclear workers should also be factored into consideration in the statement's discussion of whole body dose at the boundaries of reactor sites. (pp. 38, 39) That is, EPA seems to provide assurance that the average whole body dose to the population is vanishingly small, since the maximum whole body dose at the boundaries of a reactor site would be less than 6 millirem per year.. This is a misrepresentation, however, in that the genetically significant dose to nuclear workers, averaged over the entire child bearing population, is roughly equivalent to this maximum whole body dose at the boundary.55/ The final statement should include a discussion of this effective added

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55/ For the year 2000, the occupational exposure is 1.6 million person-rems to be distributed into the population. Assuming roughly one-half of the population is of childbearing age, there would be 800,000 person-rems distributed into 100 million people, for an average genetically significant dose of 8 millirems.

gonadal exposure to the general population in the section on the radiation effects of nuclear power reactors.

Using the NAS Committee estimates for genetic effects induced in the general population by radiation exposure of 5 rem per generation, 1.6 million person-rems annually to workers for 30 years would eventually result in about 3,000 to 75,000 serious genetic diseases in the nuclear workers' descendants.[56/] EPA should carefully consider this impact in its evaluation of the total harm caused by the nuclear power industry.

[56/] NAS-NRC, Division of Medical Sciences, Report of the Advisory Committee on the Biological Effects of Ionizing Radiations, The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, p. 57 (November 1972).

III

THE DRAFT ENVIRONMENTAL IMPACT STATEMENT DOES NOT CONTAIN AN ADEQUATE COST-RISK-BENEFIT ANALYSIS

The calculation of the economic costs and benefits of the proposed action and alternatives is wholly inadequate because it fails entirely to consider (1) uncertainties in the extent of health effects caused by radiation exposure of the population, (2) the effects of radionuclides released to the environment during the entire time they emit radiation, (3) the genetic effects on members of the general population due to occupational exposures of nuclear workers, and (4) the extent of radionuclides released during unplanned, unusual or abnormal operations.

The last three issues have been discussed in Chapter II, above, and will, we hope, receive adequate attention in the final statement. The issues of the extent of harm potentially caused by chronic, low-levels of radiation also requires consideration by EPA in the final statement.

The draft statement concludes that the linear, non-threshold, dose-rate-independent model ". . . is the prudent one for use in deriving radiation standards to protect the public." (p. 21, footnote deleted) We agree that it is reasonable to use that model for calculational purposes. However, because the linear hypothesis is not necessarily conservative, NRDC does not agree that the linear hypothesis is always "prudent".

Professor Karl Z. Morgan has recently commented on the possible reasons that the linear hypothesis may not be conservative as follows:

> "Often it is stated in the literature that the linear hypothesis, as presently applied, is a very conservative assumption. During the past few years, however, many studies have indicated that this probably is not true in general and that at very low doses and dose rates somatic damage per rad probably is usually greater than would be assumed on the linear hypothesis. There are many reasons for this, some of which are:
>
> 1. The linear hypothesis is based on extrapolations to zero dose of effects of radiation on humans at intermediate to high doses. The points used on the curves at high doses may be on the down part of the curve . . . i.e. from the portions of the curve where a large fraction of the highly exposed died of other types of radiation damage and did not survive to die of the radiation effect under study.
>
> 2. The extrapolations are made on human data which in general relate human damage such as bone cancer for observation periods of no more than about 20 years. Many of the conclusions are based on studies of animals of life spans less than 10 years. Since man lives for more than 70 years, the slopes of these curves can only increase as more human data are accumulated over his entire life span.
>
> 3. The linear hypothesis assumes that man is a uniform and more or less homogeneous population. It applies to the average man and may not be sufficiently conservative for the fetus and for old people. It never takes into consideration special groups such as . . . [children with allergies, bacterial or viral diseases].
>
> 4. There may be cell sterilization at intermediate and high doses. By this we mean there may be many cells in the body which are likely targets to become precursors of a clone of cells which are malignant but they are killed by the higher doses. In other words, these cells may already have two of the 'series cancer switches' closed and a low dose of radiation would likely close the last switch in the final step toward cancer production. A high dose, however, might kill most such cells as it does in radiation therapy which is used to destroy a cancer.
>
> 5. For many types of radiation damage the best fit curve is a plot of equation $E = CD^n$ in which E = effect, C = constant, D = radiation dose, and n = constant. For the linear hypothesis $n = 1$. In some cases $n > 1$ indicating lesser damage at low doses but in many cases the best fit to experimental data is obtained when $n < 1$. Baum (16) recently showed a best fit for cancer induction when $n = 1/2$. In such case the linear hypothesis would be non-conservative.
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> (16) Baum, J., "Population Heterogeneity Hypothesis on Radiation Induced Cancer," given orally at Houston, Tex. meeting of the Health Physics Society, July 10, 1974."[57]

A recent National Academy of Sciences report indicated that there are three major unknowns which limit our knowledge of the possible full impacts of a specified level of radiation exposure. These are uncertainty about (1) the length of the plateau period for solid tumors, (2) the latent periods for types of cancer not yet thought to be radiogenic, and (3) whether or not "radiation acts to multiply or to add to spontaneous levels."[58] As additional information becomes available during the next 20 or 30 years, the NAS panel concluded that ". . . present risk estimates [could be refined] down by a factor of 2 or up by a factor of 3 to 4."59/

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[57] K. Z. Morgan, "Reducing Medical Exposure to Ionizing Radiation," Landauer Memorial Lecture given at Stanford University, September 27, 1974. [AIHA 36 (May 1975)]

[58] National Academy of Sciences, Report of an Ad Hoc Panel of the Committee on Nuclear Sciences, National Research Council, "Research Needs For Estimating The Biological Hazards Of Low Doses Of Ionizing Radiations," p. 29 (1974).

All identifiable and estimable uncertainties should be factored explicitly into the cost-benefit analysis in the final statement.

59/ Id. at p. 30.

IV

THE PROPOSED REGULATIONS ARE TOO WEAK, VAGUE AND DO NOT ADEQUATELY IMPLEMENT THE ENVIRONMENTAL PROTECTION AGENCY'S RADIATION PROTECTION GOALS AND RESPONSIBILITIES

Five years ago the President's Reorganization Plan No. 3 transferred from the former Atomic Energy Commission to the Environmental Protection Agency responsibility for setting ". . . generally applicable environmental standards for the protection of the general environment from radioactive material." (p. 117) Pursuant to this new responsibility under the Reorganization Plan, in September 1973, EPA had prepared, in draft form: a "Statement of Considerations" in setting environmental radiation standards for the uranium fuel cycle, a Federal Register notice of proposed rulemaking, and proposed standards.60/ Due to a decision at a higher executive level outside the Agency,61/ EPA did not formally publish these materials. The regulations now proposed (40 Fed. Reg. 23420 et seq., May 29, 1975) differ in several significant ways from the earlier regulations.

60/ Statement dated January 10, 1974, and attachments provided by Director, Criteria and Standards Division (HM-560), Office of Radiation Programs, EPA.

61/ Memorandum dated December 7, 1973, from Roy L. Ash, Director, Office of Management and Budget, to Russell E. Train, Administrator, EPA and Dr. Dixy Lee Ray, Chairman, Atomic Energy Commission.

Unfortunately, the changes uniformly reduce the effectiveness of EPA's general radiation protection standards, rather than strengthen them.

A comparison of the two sets of regulations suggests that during the past two years the nuclear proponents within the Administration were successful in forcing EPA to back down from its earlier stronger regulatory stance. The specific provisions that were weakened since 1973 include, for instance, the conditions under which a "variance" from numerical standards may be obtained, the availability of information to the public, the maximum permissible annual dose equivalent to the whole body or any organ, and the effective date of the standards. Additionally, the currently proposed regulations include other serious deficiencies, which were also present in the 1973 draft regulations. These shortcomings and suggested ways to overcome them are discussed in detail below.

In general, we find that the regulations unnecessarily and improperly delegate to the Nuclear Regulatory Commission too much of EPA's responsibility to enforce "generally applicable environmental standards for the protection of the general environment from radioactive material." Implicit in a duty to establish standards is the responsibility to monitor implementation and ensure compliance. However, the proposed regulations do not assign to EPA any required role in reviewing the detailed implementation of the general standards it is preparing to promulgate. Nor is EPA directly involved in verifying compliance, reviewing variances or in making available to the public, information about the effectiveness of NRC's implementation of the standards. The lack of adequate supervision of implementation of the regulations and control over the issuance of variances is at odds with the purpose of Section 2(a)(6) of the Reorganization Plan, which is intended to give EPA the responsibility to protect the environment and public from radiation damage due to the release of radioactive substances by the nuclear power industry.

While recognizing that constraints were placed on EPA's role by the Ash Memorandum and the AEC-EPA Memorandum of Understanding (38 Fed. Reg. 24936, September 11, 1973), we believe that EPA has gone too far in relinquishing control over the effectiveness of its regulations. The specific revisions suggested below do not exceed the boundaries established by the Ash Memorandum, in our opinion, and would still substantially increase EPA's role of assuring that, in practice, the proposed standards increase protection of the public and environment from unwarranted radiation damage.

A. There Are No Procedures Providing For EPA Review Of The Implementation Of And Compliance With The Proposed Standards

Clearly, simply promulgating the proposed standards will not protect the public and environment from excessive radiation damage. The regulations must also be strictly enforced. There are basically three reviewing functions that EPA must perform in order to meet its responsibility in assuring compliance with the environmental radiation protection standards.

First, EPA should formally review the procedures and criteria adopted by the regulatory agency to implement EPA's standards. Such review should include detailed analysis of the adequacy of (1) computational models that the regulatory agency allows licensees to use in estimating radiation doses, (2) procedures used in surveying, monitoring and reporting levels of radioactivity around licensed facilities, and most importantly, (3) the specific numerical guidelines or standards for each type of facility, which are established by the regulatory agency to implement EPA's generally applicable environmental radiation protection standards. After completing its review of these matters, EPA should periodically report to Congress and to the public its conclusion about the adequacy of the regulatory agency's implementation program and, where the program is deficient, make specific recommendations for achieving the needed improvements.

Second, EPA should review the data generated by the licensees and regulatory agency. The AEC-EPA Memorandum states that the AEC will supply EPA with data relevant to radioactive effluents. However, the detailed mechanisms for transmittal of the data are not specified, nor are there adequate provisions for making the information available to the public in an easily understandable form. To correct these deficiencies EPA's regulations should specify how, what and when data are to be transmitted from the regulatory agency to the EPA. Furthermore, there should be specific procedures for making both the regulatory

agency's data and EPA's evaluation of the adequacy of the data available to the public upon request.

For instance, annually the regulatory agency should report to EPA about (1) emissions of radioactive materials, in curies by radionuclide, leaving the boundary of each licensed facility, (2) the maximum annual dose equivalent to the whole body and the thyroid to any member of the public as the result of all licensed activities, (3) the estimated total population exposure in person-rems resulting from all licensed activities, and (4) the total person-rems of the gonadal and fetal occupational exposures at each licensed facility, during the previous calendar year. (These reports to EPA should be made available to the public upon request.) Within a reasonable time, EPA should publish a report analyzing the data submitted by the regulatory agency and state whether or not the generally applicable radiation standards -- as set forth as proposed Section 190.10(a) and (b) -- had been met.

The EPA should also independently conduct an environmental radiation survey around all facilities either granted a variance by the regulatory agency or shown by the data submitted to EPA of potentially being in violation of the proposed standards in Section 190.10(a) and (b). The results of each survey and EPA's conclusions based on the survey and other pertinent information should be made publicly available within a reasonable period of time.

Third, EPA should review the granting of variances by the regulatory agency to ensure that any variances granted do not produce significant levels of human exposure to radiation and releases of radionuclides to the environment in comparison with EPA's standards.

Proposed Section 190.11 allowing variances is too vague and permissive. In order to correct these deficiencies, the proposed section should be revised to correspond more closely to Section __.22 of the September 1973 draft regulations. In particular, the regulations should specify the information to be provided by an applicant for a variance and the procedures and criteria to be followed by the regulatory agency in evaluating the application for a variance. EPA should require the regulatory agency to prepare a statement setting forth the nature and duration of the variance as well as the detailed reasons for the action prior to the actual granting of a variance. Also, the procedures and requirements for making information about variances available to the public must also be clearly specified.

Additionally, because the only reason put forward to justify the issuance of a variance is "to protect the overall societal interest with respect to the orderly delivery of electrical power," (p. 143) variances should be permitted by the regulatory agency only for electrical generating stations.[62]

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[62] We can see no need to allow variances for other fuel cycle facilities, e.g., spent fuel reprocessing plants, in order to maintain the "orderly delivery of electrical power," (p. 8) if, as EPA hopes, variances will be granted for short durations only (p. 137). In the event that variances are required for facilities other than power plants, e.g., to alleviate a serious regional or national economic situation, or a long-term energy shortage, there should be ample time for special consideration and review, including public input, by EPA.

Furthermore, variances for operation of light-water-cooled reactors should not be permitted unless a portion of the power which could be generated by such a reactor is required to prevent a power emergency and only then subject to the following conditions:

1. Releases of radioactive substances are kept as low as technically possible;
2. The operator of the reactor utilizes the variance only as long as is deemed necessary by the regulatory agency to meet the power emergency;
3. All power available from inside or outside of the utility system has been utilized and/or purchased and appropriate load shedding has occurred;
4. The annual whole body and organ dose equivalent limits specified in Section 190.10(a) for individuals of the general public are not exceeded; and
5. Notice of issuance of the variance is published concurrently in the Federal Register and a newspaper of general circulation in the affected area, and a statement justifying the variance is made available to the public.

The notice should include the name and location of the facility the nature of the emission for which the variance is being granted, the anticipated duration of the variance, the maximum individual dose estimated to result from the variance and the reason for the variance.[63]

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[63] See, EPA, Draft Environmental Radiation Protection Standards for Normal Operations of Activities in the Uranium Fuel Cycle, Subpart C, Section __.22 (September 1973).

Finally, in order to assist the regulatory agency as far in advance as possible, we suggest that EPA's detailed evaluation regarding the adequacy of the Nuclear Regulatory Commission's recently promulgated Appendix I to 10 C.F.R. Part 50, which establishes numerical guides for light-water-cooled reactors, be included in the final statement. (40 Fed. Reg. 19439 et seq., May 5, 1975) Unfortunately, Appendix I, as adopted, differs significantly from the proposed Appendix I, a version which EPA indicated would be consistent with the generally applicable environmental radiation protection standards. (p. 137) In particular, we call EPA's attention to the following provisions of Appendix I which do not appear to us to be consistent with EPA's radiation protection philosophy and proposed standards:

1. NRC places emphasis on the annual dose or dose commitment of premitted releases, and not on the environmental dose commitment concept endorsed by EPA.
2. Specific numerical limits on the amounts of radionuclides that can be released are not established, as would be required by Section 190.10(b) of EPA's proposed standards.
3. Radiation exposure limits are on a per reactor basis rather than on a per site basis. Thus, Appendix I may not set stringent enough limits to meet EPA's proposed standards for energy centers.

4. The licensee is not required to initiate corrective action unless ". . . rates of release of quantities and concentrations in effluents actually experienced over any calendar quarter indicate that annual rates of release were likely to exceed 2 times the design objectives . . . ." (40 Fed. Reg. 19441). Such a policy does not seem consistent with EPA's hopes that unplanned releases will be small and of short duration.

B. Vague And Unduly Restrictive Definitions Further Limit The Usefullness Of The Proposed Standards

The definitional section of the proposed regulations is very important. It should be intended to eliminate any ambiguities in the body of the standards. Unfortunately, many of the definitions in the proposed standards are themselves unduly ambiguous and, in some cases, overly restrictive.

Some of these ambiguities are enumerated below; clarifying language and interpretation are suggested for consideration in drafting new definitions. Generally, NRDC believes that to the extent a definition reduces the applicability of the regulations to potential radiation exposure from activities associated with the generation of electricity at nuclear power plants, such limitations must be justified in detail in the environmental impact statement. It should be noted that Section 2(c) of the Reorganization Plan contains no indication of a limitation on the scope of EPA's authority in this regard. Therefore, limitations of applicability are permissible only if justified by a showing that the possibility of exposure from the excluded sources of radiation are insignificant or that the benefits of exclusion from regulatory control substantially outweigh the risks from exceeding the standards.

1. Uranium Fuel Cycle - (a) The principal failing of this definition in the proposed standards is the omission of mixed-oxide fuel fabrication plants. Because, as discussed above, the NRC is seriously considering licensing such facilities, as part of the light-water-cooled reactor cycle, there should be no exclusion for fuel fabricating plants that use plutonium.

Additionally, as discussed above, uranium mines and low- and high-level waste burial facilities should not be excluded. Such facilities are integral parts of the fuel cycle and should be operated in uniformity with EPA's radiation protection standards.

(b) This definition also excludes from coverage facilities which have stopped "conducting operations." Thus, at least one important potential source of radiation exposure, abandoned uranium mill tailings, apparently would be exempt from the standards. Because studies show that the gamma radiation dose rate at three feet above uranium mill tailings may be 1 mrem/hr or more,[64] there does not appear to be any justification for this limitation. Furthermore, as was discussed above, the long-term release of radon gas from tailings piles may have a substantial overall adverse effect on the public health. We suggest adding the words "or have conducted" immediately after the word "conducting." This would have the additional benefit of extending coverage to the "decommissioning" of facilities.

(c) The meaning of the phrase "all facilities. . . to the extent that these support commercial electrical power production utilizing nuclear energy. . . ." is also open to overly restrictive interpretations. For instance, this phrase might be read as limiting the applicability of these regulations to only that fraction of a facility's activities which supports commercial nuclear power in the United States. EPA should make clear that all effluents from facilities which even partially support the production of electricity in the United States or elsewhere are covered by the proposed standards.

Furthermore, use of the word "commercial" might be interpreted to exclude reactors and other facilities operated by governmental agencies, even though the electricity generated is used in the private sector. In light of recent suggestions that the federal government purchase nuclear power plants,[65] we believe that this potential loophole should be firmly closed.

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[64] Harris, et al., "Environmental Hazards Associated With The Milling of Uranium Ore: A Summary Report," HASL-40, p. 15, Table X (June 4, 1958); Duncan and Eadie, U.S. EPA, "Environmental Surveys of the Uranium Mill Tailings Pile and Surrounding Areas, Salt Lake City, Utah," p. 33 (August 1974).

[65] See, for instance, Carter, "Nuclear Power: Westinghouse Looks to Washington for a Customer" in Science 189, p. 29 (4 July 1975); U.S. Energy Research and Development Administration, Nuclear Fuel Cycle, ERDA-33, p. xiii (March 1975); and Nucleonics Week, p. 7 (August 7, 1975).

A third ambiguity in this definition is the applicability of the standards to reactors, such as the N-reactor on the Hanford Reservation, which supply steam for the generation of electricity for sale to utilities as a by-product to its primary purpose -- the production of plutonium.

2. Site -- The meaning of controlled access is improvidently left to future interpretation. One can control access of the public by many possible means ranging from erecting an impenetrable physical barrier to posting "Keep Out" signs. EPA should give guidance concerning the degree to which access should be "controlled."

3. Uranium Ore -- The restriction to ore containing only 0.05% or more of uranium by weight is evidently based on the AEC's definition of source material (10 C.F.R. 40.4(h)). However, the reasoning that led the AEC to exempt from licensing requirements activities involving less than 0.05% uranium by weight (10 C.F.R. 40.13(a)), may not be valid for excluding less rich ores from EPA's generally applicable radiation protection standards. If demand for uranium increases sharply and there is a commensurate increase in the price of uranium, lower grade ores may be processed to obtain uranium.66/ We suggest that no reference be made to the quality of ore in the definition. The crucial point is whether or not uranium is extracted for eventual use in light-water-cooled power reactors. However, if the Agency wants to exclude lower grade ore, then the final statement should discuss this point and explicitly give the Agency's reasoning for the exclusion.

4. Member of the Public -- This definition is unjustifiably restrictive. The higher allowable dose for individuals exposed while working in a nuclear fuel cycle facility is usually justified on the basis that such individuals reap directly the benefits of such exposure and have voluntarily submitted themsevles to the risks. This rationale is not valid, however, to genetic or fetal doses since it is not the workers but their progeny, who will be harmed by the exposure. Thus, the injury from genetic and fetal doses are suffered by individuals who, like the members of the general public, neither reap a direct benefit nor have voluntarily assumed the risk of exposure. The proposed regulations should explicitly include restrictions on genetic and fetal exposures of nuclear power workers.67/

66/ See, for instance, Battelle Pacific Northwest Laboratories, Assessment of Uranium and Thorium Resources in the United States and the Effect of Policy Alternatives, pp. 5.21-5.30 (December 1974).

67/ If EPA adheres to the view that it is prohibited by the Reorganization Plan or the Ash Memorandum from setting standards limiting genetic and fetal doses, then EPA should use its authority from the former Federal Radiation Council at least to advise the President about the need to reduce the maximum permissible genetic and fetal doses of nuclear workers.

5. Normal Operations -- Although Section 190.10 appears to restrict application of the proposed standards to "normal operations," the definitional section (§ 190.02) does not specify what are "normal operations," in comparison with "unusual operations" for which a variance is required by § 190.11. A major difficulty, we believe, is determining which releases from individual facilities may result in violation of the overall primary standards.

In order to reduce this difficulty, the regulatory agency should be required quickly to establish limits on the releases of all critical radionuclides from individual facilities under typical operating conditions, consistent with EPA's generally applicable radiation protection standards. EPA should then certify, first, that individual facilities can, in fact, typically operate within the NRC's limitations and, second, that with all facilities operating under such conditions, EPA's overall standards would be met. Then, "abnormal" or "unusual" operating conditions could be defined in terms of the NRC release limits for individual facilities.

C. The Proposed Standards Should Set Limits On Total Releases Of All Critical Radionuclides.

The proposed regulations set limits on the total amounts of krypton-85, iodine-129 and alpha-emitting transuranic radionuclides (including plutonium-239) that can be released to the general environment annually. EPA has correctly adopted an approach to radiological protection of the public involving emphasis on the actual long-term health effects rather than, for instance, on the rate of exposure caused by a particular radiation source. However, EPA's proposed regulations do not contain limitations on two radionuclides, radon-222 and carbon-14, that, according to EPA's own analyses, would contribute more to human exposure than the radionuclides that would be controlled by the proposed regulations. Furthermore, at least two additional radionuclides, strontium-90 and cesium-237, are not even considered in EPA's analyses, although EPA has admitted elsewhere that they potentially may cause significant long-term human exposure.[68]

EPA should correct this problem by setting firm limits on releases of carbon-14 and radon-222 consistent with the likely development of control technology. EPA also should set out a schedule for determination of the potential health effects that may be caused by planned releases of strontium-90 and cesium-137 and for promulgation of standards limiting their release into the general environment. This information should be provided within the context of the proposed rulemaking in order to give as much advance notice as possible to the nuclear power industry about the standards it will have to meet in the future.

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[68] Environmental Radiation Dose Commitment: An Application to the Nuclear Power Industry, EPA-520/4-73-002, p. 11 (February 1974).

1. Carbon-14 -- The analysis in the draft statement shows that the total number of ill-health effects caused by the unregulated radionuclide carbon-14, even on the basis of EPA's arbitrary and improper calculation which is limited to 100 years following discharge, may be more than 10-fold greater than the reduction in the ill-health effects achieved under the proposed standards (i.e., 12,000 compared to 1210-180 = 1030). p. 82) If the number of effects are calculated over the full lifetimes of the radionuclides, the relative hazard of carbon-14 is probably even greater.

EPA states that a limit for carbon-14 was not proposed ". . . only because control technologies . . . are not yet commercially available." (p. 81) EPA, however, promises ". . . carefully [to] follow the development of new knowledge concerning both the impact and controllability of these [carbon-14 and tritium] radionuclides." (p. 133) We submit that this is an inadequate response to EPA's duties to protect the environment and public health from the potential hazards posed by a burgeoning nuclear power industry.

The excuse that carbon-14 should not be restricted by the newly proposed regulations simply because adequate control systems are not now commercially available rings hollow for two reasons. First, and most importantly, this type of argument in general is inappropriate for setting radiation protection standards. Standards are devised to protect the public, not to permit the industry to proceed apace. It is the industry that must modify its practices to conform with the standards required to protect the public health, not the other way around. The burden of proof should be on the industry that an exemption to reasonable standards is necessary. At this time, EPA should not make a judgment to risk the public health unduly without detailed evidence that control of carbon-14 is not feasible in the next few years and that the release of carbon-14 is amply justified by the benefits obtained from the processes producing carbon-14.

Second, the fact that equipment to control releases of krypton-85 below the proposed standards is not now commercially available did not prevent EPA from proposing those limits. And rightly so. Furthermore, as EPA admits, control of a "substantial fraction" of the impact of carbon-14 releases ". . . may be achievable through inexpensive modification of systems that are installed to meet the requirements of the proposed standards for krypton." (p. 84) However, if the industry finds that technology cannot be developed to meet the standards, then the industry must make its case, fully and publicly, before EPA takes steps to relax a proposed standard for carbon-14.

Thus, EPA should, consistent with the proposed standards for krypton-85, set a limit on the total release of carbon-14, which may be one to three or more orders of magnitude more harmful than the projected releases of krypton-85. Besides appropriately giving the public and environment greater protection if fully implemented, a proposed limit on carbon-14 releases at this time would put the industry on advance notice about EPA's intentions and force it to conduct, as it should, the necessary research and development for controlling releases within the standard.

2. Radon-222 -- The radionuclide radon-222, which emanates in large quantities from uranium mines, mills and mill tailings piles, and its decay products are specifically excluded from the proposed standard for maximum dose; and no limit is placed on the amounts that the industry may discharge into the general environment each year. (pp. 133-314) The draft statement suggests three reasons for this major exemption. "There exists considerable uncertainty [,first,] about the public health impact of existing levels of radon in the atmosphere . . . [and, second, about] the best method for management of new sources of radon created by mans' activities . . . ." (p. 133) And, third, "[e]xposures from radon and its daughters have previously been the subject of Federal Radiation Protection Guidance, in the case of underground uranium miners . . . , and of guidance from the Surgeon General, in the case of public exposure due to the use of uranium mill tailings in or under structures occupied by members of the general public. . . ." (p. 134)

These justifications are not consistent with EPA's approach in regulating other radionuclides and, in any event, are not persuasive. The draft statement, in fact, contains no valid reasons for not including radon (and its decay products) exposure in the maximum permissible dose and for not setting a limit on the total amount of radon that can be released to the general environment each year.

There is "considerable uncertainty" in the calculation of the health effects due to the release of radionuclides that are covered by the proposed regulations. For instance, the draft statement admits that the total impact of transuranic radionuclides is only very approximately known. (pp. 129-130) Furthermore, the amount of plutonium, for instance, already in the environment due to weapons testing is large. Yet, EPA has correctly argued in the case of transuranic radionuclides that restrictions on additional planned releases are justified.

Similarly, the fact that a substantial amount of naturally occurring radon exists in the air does not change the fact that an additional quantity, which could produce harmful effects, will be generated by man. Since this additional amount is controllable, whereas the level of naturally occurring radon is not, EPA should focus on how to reduce man-caused releases of radon. Also, we note that EPA was able, in its technical back-up report for rulemaking, to estimate the potential ill-health effects due to the emanation of radon from uranium mill tailings piles.[69]

Furthermore, general agreement at this time on the "best method" for limiting radon releases is not required before standards are proposed. There is no such agreement in the case of krypton either. Yet, quite correctly, EPA is proposing limitations on releases of krypton. However, several technically and economically practical means exist for substantially reducing the amounts of radon released from uranium mill tailings, according to a detailed report for the Nuclear Regulatory Commission.70/

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[69] EPA, Environmental Analysis of the Uranium Fuel Cycle, Part I - Fuel Supply, EPA-520/9-73-003-B, pp. 51-74 (October 1973).

Therefore, EPA has avilable to it an assessment showing that technically economically practical methods are available to reduce substantially the emanation of radon from tailings piles. This is all that is required prior to the inclusion of radon releases in the proposed standards.

D. The Scope Of The Proposed Regulations Should Be Expanded To Include All Nuclear Fuel Cycles.

Section 190.10, "Standards for Normal Operations," applies only to the uranium fuel cycle. As discussed above, we believe that EPA has defined the "uranium fuel cycle" too narrowly by excluding plutonium recycle operations and other activities and facilities associated with the complete uranium fuel cycle. Additionally, however, the restriction of the proposed radiation protection standards to the full uranium fuel cycle, that is, including the activities now omitted, would still not sweep broadly enough for the purposes of Section 190.10.

The nuclear power industry and ERDA will be placing increasing reliance on the thorium fuel cycle. Already, one large commercial High Temperature Gas Reactor, which uses thorium fuel,

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70/ Sears et al., Correlation of Radioactive Waste Treatment Costs and the Environmental Impact of Waste Effluents in the Nuclear Fuel Cycle for Use in Establishing "as Low as Practicable" Guides - Milling of Uranium Ore, ORNL-TM-4903, Vol. 1, May 1975.

has been constructed. HTGR's will increase in number to about 15% of new non-breeder additions by 1990.71/ In our opinion, EPA should include the thorium fuel cycle within the purview of its proposed regulations in order to protect the environment and public consistent with its overall regulatory objectives and in order to give the infant thorium industry adequate advance notice about the standards it will have to meet.

E. The Proposed Regulations Should Contain A Section Limiting Occupational Exposures That Result In Damage To Future Members Of The General Population.

As discussed above, two radiological consequences of the nuclear fuel cycle are an increased number of deleterious genetic mutations affecting future members of the general population, and radiation damage to fetuses (or unborn members of the general population). Gonadal and fetal exposures do not fall within the usual meaning of "occupational exposures" in the sense that no direct benefit is received to compensate for the potential harm and the future members of the population have no choice as to whether or not they receive the radiation exposure. Thus, in our opinion, it is appropriate to set limits

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71/ Testimony of Roger W.A. Legassie, Assistant Administrator for Planning and Analysis, ERDA, at U.S. Committee on Interior and Insular Affairs, Subcommittee on Energy and the Environment, Hearings on Growth Rates of Electricity and the Role of Nuclear Energy, p. 10 (April 28, 1975).

on gonadal and fetal radiation exposures within the context of the proposed regulations.

In order to protect the fetus, the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements recommend that fertile women workers (with respect to the fetus) receive no more than a maximum dose of about 0.5 rem during the gestation period.72/ This lower dose is consistent with the conclusions in the BEIR report that the human fetus may be particularly susceptible to leukemogenesis and other carcinogenesis following radiation exposure.73/

When the genetic effects to future generations, as estimated in the BEIR report74/ are considered, a reduction in the maximum permissible exposure to 0.5 rem per year for all nuclear workers appears amply justified.75/ The proposed regulations should limit the genetically significant dose and the fetal dose to 0.5 rem per year in order to protect adequately future members of the general population.

72/ NCRP, Review of the Current State of Radiation Protection Philosophy, Report No. 43, pp. 34-36 (January 15, 1975).

73/ National Academy of Sciences-National Research Council, The Effects on Population of Exposure to Low Levels of Ionizing Radiation, p. 89 (November 1972).

74/ Id., p. 57.

75/ NRDC is in the process of preparing a report on this matter and will submit it to EPA for consideration in the near future.

F. The Proposed Standards Should Set Limits On The Total Releases Permissible Due To Abnormal Operations.

The limits that would be established by the proposed standards apparently pertain only to normal operations of the uranium fuel cycle. EPA optimistically assumes that unplanned releases will not significantly contribute to the environmental burden of radioactivity and radiation exposure of humans.

On the other hand, there is reason to doubt that the industry will continually meet the justifiably high standards proposed by EPA. If "abnormal" releases of radionuclides were regularly to exceed the values in the proposed standards, then, obviously, the effectiveness of the standards would be substantially reduced. Therefore, in order to ensure that unplanned, abnormal, or unusual releases do not become excessive, NRDC recommends that the proposed limitations on total releases of radionuclides include all releases from the nuclear fuel cycle without the current implied exemption for "abnormal" or "unusual" operations.76/

76/ In any event, the phrases "normal operations" and "unusual operations" should be clearly defined and not left unduly ambiguous, as they are now. In particular, EPA should spell out in detail how the regulatory agency would determine when a variance is required.

V

CONCLUSION

For the reasons set forth in detail above, NRDC finds that the draft statement does not meet the requirements of the National Environmental Policy Act. Furthermore, NRDC finds that the proposed standards are wholly inadequate to achieve the objective of protecting the public and environment from unduly high levels of radiation from operations of the nuclear power industry.

P. O. Box 1393
Ventura, Ca. 93001
September 30, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Reference your invitation for comments from the public. The Proposed Standards for Radiation Protection for Nuclear Power Operations, Federal Register, Thursday May 29, 1975, Vol 40, Number 104, part II, are in disregard of human and animal life and are therefore totally unacceptable.

The proposed standards are legally, morally, socially, and economically unacceptable. Legally, the proposed standards are not in accordance with the United States Constitution which guarantees life, liberty, and the pursuit of happiness. Morally, the production of electrical power by nuclear reactors does not justify the continued long term widespread poisoning of our environment and the associated disease, death, and destruction of our genetic inheritance. For example largely because of the nuclear pollution of our environment to date one in four or around 50,000,000 Americans are expected to develop cancer. This is more individuals than were put to death during WWII I believe, and cancer of course is only one aspect of the public health problem being created. Economically, when the total costs of the public health problems created are added to the overall costs of nuclear power production, the economic cost is astronomical and totally unacceptable, indeed destroying the economic viability of our system.

Since the nuclear industry has clearly demonstrated its inability to produce electrical power consistant with the economic, social, moral, and legal best interest of our society over the last quarter of a century, existing nuclear power production facilities should be converted to use natural gas or other convenient fuel rather than nuclear fuel as the heat source for the generation of steam to produce electricity. The nuclear reators can be retained on site for use in the case of a national emergency or any future energy difficulties which would justify their use, and can be used if needed until the alternate boilers are installed and operational.

I would appreciate a copy of the results of the air, water, oil, tobacco, and food samples your agency has monitored this year for all forms of radiation contamination, and the results of the members of the general public checked for radiation body burdens, as well as animals and fish so monitored, particularly in California and Nevada. Has there been a significant increase in nuclear pollution this year, and is it caused by the increased nuclear weapons testing in Nevada or increased world wide pollution from weapons testing, etc.? What facilities are available to the public in California that will perform body burden testing? What is the cost involved? Are imported oil and foodstuffs monitored for radiation?

Finally I would like to know the status of your involvement in standards for non-ionizing radiation. The public health impact of our present nuclear pollution problem is second only to the public health problem created by the non-control of non-ionizing radiation, causing damage to the CNS and thus affecting the performance of the EPA.

Until the world ends,

David E. Eakle

cc: President Ford
Congressman Lagomarsino

Cornell University
LABORATORY OF ATOMIC AND SOLID STATE PHYSICS
CLARK HALL · ITHACA, NEW YORK 14853

October 13, 1975

Director
Criteria and Standards Division
AW-560
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Gentlemen:

I wish to comment on your "Draft Environmental Statement on the Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle" (May 12, 1975).

Based on a study of the United States Environmental Protection Agency it has been shown (see enclosure) that the radon-222 emanating from the uranium mill tailings piles in the U.S. alone will, be the year 2000, increase the average atmospheric radon concentration in the U.S. by ~0.5%, if the nuclear energy consumption develops according to current forecasts and if no disposal methods for the tailings will be introduced. Since the radon results from the decay of thorium-230, whose half-life is 76,000 years, the man-made increase of the radon concentration will persist into the indefinite future, even though the half-life of the radon is short (3.8 days). If the current rate of radon-induced lung cancer deaths in the U.S. is estimated as 4,000/year, then the additional radon will cause 20 additional cases every year in the U.S., and another 20 in the Northern Hemisphere, assuming the population to remain constant at the present level.

Since your draft considers carefully the health impact of krypton-85, a comparison between these two isotopes may be useful: Based on the concept of the environmental radiation dose commitment, the health impact of krypton-85, i.e. the number of serious health effects/GW(e)y of electrical energy produced, is 0.034/GW(e)y for krypton-85. The amount of the tailings quoted above will generate approximately 10^4 GW(e)y in LWR's. Hence, the krypton from that energy would be expected to cause a total of $3.4 \times 10^{-2} \times 10^4 = 340$ cases of serious health effects, worldwide. The radon from the tailings accumulated from the generation of the same energy will cause the same number of serious health effects in less than 10 years. Over a period of 100 years, it will cause [illegible],000 such effects, and so on.

In view of this comparison it seems highly desirable to include radon emission standards into your draft, and to present estimates of the costs of avoiding the health impact of this isotope. Note that the only responsible solution is one that would guarantee isolation from the biosphere for periods on the order of the half-life of thorium-230 and that seems to exclude all disposal

Director
October 13, 1975
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methods other than to reseal the tailings in deep mines.

Sincerely yours,

Robert Pohl

Robert O. Pohl

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July 1975

Nuclear Energy: Health Effects of Thorium-230

Robert O. Pohl

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The uranium mill tailings represent a substantial and so far largely neglected health hazard in the nuclear fuel cycle.

Introduction

In every debate on nuclear energy, its proponents emphasize two points:

1) The costs of nuclear energy in terms of human health are between one hundred and ten thousand times smaller than those of energy produced from coal.

2) Although the nuclear waste is highly toxic, it is concentrated in a small volume which simplifies its safe disposal.

In this paper, we want to show that both of these claims are incorrect, because the waste generated at the uranium mill has not been taken into account. The following discussion is based to a large part on "Environmental Analysis of the Uranium Fuel Cycle", a report published by the U.S. Environmental Protection Agency in October, 1973 (1).

As an introduction, it may be useful to review what we consider to be the only acceptable method of determining the health costs of nuclear energy (2): The generation of a certain amount of electrical energy W in a fission reactor results in a certain number $n_{o,i}$ of radioactive nuclei of a certain isotopic species, i. A fraction of these nuclei will enter the biosphere, and as they decay with a certain decay rate (unit: Curie) characterized by their half-life $\tau_{1/2,i}$, they will cause a radioactive dose rate to be absorbed by every person (unit: rem/year). The entire population will receive the so-called population dose rate R_i from these nuclei (unit: man rem/year); R_i varies with time. By the time all nuclei have decayed, i.e. after many half-lives, the nuclei will have caused a certain integrated dose among the population (unit: man rem). Because of the long half-lives of some isotopic species, this dose may be spread over many generations. The technical term for this dose is environmental radiation dose commitment, D_i (3). A certain number N_i of somatic and genetic health effects will be caused by D_i. The connection between dose and health effect has recently been reviewed in the BEIR Report (4). Some of these health effects, say F_i, will be fatal, and hence one can express the impact of the energy W on the health of the present and of all future generations as the sum F of all F_i caused by the different isotopes resulting from the generation of W divided by this energy W (unit: Number of deaths/unit of energy. As the unit of energy we will use the GW(e)y = 10^9 watt year of electrical energy.) Let us call F/W the health impact (it can be translated into health costs by assigning a certain dollar value to a life lost). Note that F is the number of people committed to die as result of the energy produced, regardless of when they die. In that sense, F/W corresponds to what the economists call the "forward costs" of a product, to be distinguished from the annual costs, which are like installment payments.

Previous estimates (5) of the health impact of nuclear energy have been of the order of 0.01 deaths/GW(e)y among the general public, and 1 death/GW(e)y among workers in the nuclear industry (only part of the latter were caused by radiation, the rest by injuries). Similarly, estimates of the impact of electrical energy from coal were about 100 deaths/GW(e)y (70% among the general public, mostly from air pollution, and 30% from occupational accidents). A critical look at the assumptions made and the models used which resulted in these favorable numbers for nuclear energy would be of interest (6). For the sake of brevity, however, this will not be done in this paper. Instead, we will consider only the contribution of one single isotope, thorium-230, through some of its radioactive daughters. Their health effects had not been considered in the earlier studies. We will ignore the health effects

of all other isotopes and all health effects due to accidents in the nuclear industry.

Thorium-230 and its Daughters

The generation of 1 GW(e)y in a reactor burning uranium-235, operating with a 33% conversion efficiency from thermal to electrical energy requires fissioning of 1.16 tons of uranium-235. Natural uranium contains 0.71% of this isotope, the rest is uranium-238. Hence, 1 GW(e)y of electrical energy requires the mining of 162 tons of uranium. Presently mined ore contains 0.1 - 0.2% uranium (by weight), and hence 8 x 10^4 to 1.6 x 10^5 tons of ore have to be mined in order to generate 1 GW(e)y. Since both uranium isotopes are naturally radioactive, the ore will also contain their daughters. The decay series for uranium-238 is listed in Table I. In equilibrium, the rate of decay of any one of the daughters is equal to its rate of generation ("secular equilibrium"). From this we can calculate the numbers of each isotopic species present in the ore in equilibrium with the parent isotope.

At the uranium mill, the ore is crushed and ground, and the uranium is chemically separated (7). The residue, containing all the non-uranium daughters in a water insoluble form, is discarded on the tailings pile. From there, the chemically inert noble gas radon-222 can escape into the atmosphere and can be carried over long distances. Thus, radon and its daughters can affect large numbers of people. The EPA study estimated the health effects of this gas and its short-lived daughters polonium-218 and 214, lead-214 and bismuth-214. It was found that from a pile resulting from the mining of the uranium required to supply 159 GW(e)y, ~60 health effects (lung cancer) would be committed during the first 100 years after milling (8). At least 95% of these lung cancers are estimated to be fatal, corresponding to a health impact rate of (60 x 0.95/159 = 0.36 deaths/GW(e)y)/100 y, apparently a rather small number.

Now, however, comes the important point: The isotope from which the radon and its daughters are produced in the mill tailings is the very long-lived isotope thorium-230. During the 100 years considered in the EPA report, only a minute fraction (dn/n_o) of the thorium-230 will have decayed, namely 0.091%. The rest will decay later, with an exponential time dependence, as illustrated in Fig. 1. The number of thorium nuclei which decay during the first 100 years is represented by the area of the trapezoid under the curve as indicated, of the width dt = 100y; on the scale of the drawing, this width is actually invisibly narrow. Hence, the total number of health effects to be expected will be larger by the ratio of the total number of thorium-230 nuclei orginally in the pile divided by the number of nuclei which decay during the first 100 years, or by the ratio of the area under the curve out to an infinite number of years divided by that of the trapezoid. Hence, the health impact resulting from the thorium-230 is $F_{Th-230}W \cdot 0.36/0.091\% =$ 396 deaths/GW(e)y (9).

This number completely dwarfs the previous estimates of the health impact of nuclear energy, and makes it comparable to that of energy from coal. The mass of the waste containing the thorium is also comparable to that resulting from burning coal: About 3 x 10^6 tons of coal are burned, and an average of 3 x 10^5 tons of fly ash are produced during the generation of 1 GW(e)y of electrical energy.

The comparison of these numbers demonstrates that the much publicized differences between coal energy and nuclear energy as mentioned in the introduction are indeed non-existent, and that the only important difference

apparently is that for energy from coal, we have to pay ourselves, while for nuclear energy, we let future generations pay. In the next section, we will take a critical look at these findings.

Discussion

We will try to ask and to answer some of the questions which may have occurred to the reader during the preceding section.

1) Q: How reliable are these numbers?

A: We believe that the order of magnitude is certainly correct - at least within the assumption of the linear, non-threshold dose-effect relationship, on which all present calculations of the health effect of low-level ionizing radiation are based (4). In the Appendix, we will repeat the EPA calculation for a greatly simplified model of the atmospheric distribution of the radon gas, with which we will verify the numbers presented by the EPA.

2) Q: The dose rate to the individual resulting from the tailings piles must be very small indeed. Isn't the assumption of a linear, non-threshold dose-effect relationship rather dubious in this case?

A: The natural radon background results in an estimated dose rate of 0.4 rem/y to the bronchi of the average individual, as will be reviewed in the Appendix. We have, unfortunately, no reason to believe that this rate is below the threshold. Once the threshold is exceeded, the linear hypothesis is a good approximation for any additional radiation dose rate, no matter how small this is.

3) Q: The rate with which the health effects are caused by the radon from the piles is very small. Is it worth paying attention to such effects?

A: The rate with which the radon affects the human health is 3.6 x 10^{-3}/GW(e)y/y, i.e. every GW(e)y of electrical energy produced will result in 3.6 x 10^{-3} deaths among the worlds population every year for thousands of years, as we saw above. The question whether this is a large or a small rate is a moral one, to which people will have different answers. It should be pointed out, however, that this rate is higher than the one resulting from the fission product isotope krypton-85, which is 2×10^{-3}/GW(e)y/y at the time of its generation (10). The health effects caused by this isotope have been a matter of concern for a long time, and have resulted in much research and engineering effort to devise means of retaining and storing this isotope. Hence it seems logical that the radon should receive similar attention. Note, however, a crucial difference between the two isotopes: The krypton-85 will cease to cause health effects on a time scale of its half-life, which is 10.76y. For the radon, this time scale is 76,000y, and hence the total number of health effects committed is approximately ten thousand times larger.

4) Q: The thorium-230 in the ore would have decayed also without having been mined. Why isn't that effect subtracted?

A: In the EPA report, it is emphasized that the radon can escape far more readily from the finely divided tailings than from the solid ore in the ground. This shielding effect is illustrated by the fact that a 20 ft. thick earth cover over the tailings pile would reduce the radon escape rate by 90% (11) (present earth covers are no thicker than 2 ft). Hence, the radon that escapes from the tailings pile was essentially isolated from the biosphere prior to the mining.

5) Q: In this case, shouldn't the thickness of the pile itself provide a reduction of the escape rate of the radon?

A: This was taken into account in the EPA study. With an average thickness of 5 meter, only 23% of the radon set free in the pile was assumed to get out (12). Were it not for this shielding, the health impact figure would be ~4 times larger, or ~1,700 deaths/GW(e)y. As the pile spreads by erosion etc, this shielding effect would be reduced.

6) Q: Is it realistic to assume that the parent isotopes of the radon will remain confined to the tailings pile for thousands of years?

A: The long-term effects of wind and water erosion and of leaching cannot be predicted. As was pointed out in the answer to the preceding question, though, these effects don't necessarily lead to a reduction of the radon emission rate. Within the limits of the accuracy of the estimate presented here, the assumption of a stable mill tailings pile appears to be a reasonable compromise.

7) Q: Can't the health effects of the thorium-230 be eliminated by re-burying the tailings in the mines from which the ore came?

A: Certainly, just as we could clean up the effluents from coal fired plants, but the volumes involved in either case are very large indeed. A 1 GW(e) coal fired plant, burning coal with a 10% ash content, produces 3×10^5 tons ash per year, which is the same order of magnitude as the mass of the tailings (~10^5 tons/GW(e)y). The only solution which currently appears to offer a reasonable promise of isolation for times of the order of $10^4 - 10^5$ years is to re-seal the tailings in abandoned deep mines. Since the tailings are less densely packed than the ores, and since about 50% of the ore presently mined come from open pit mines, abandoned uranium mines will not have enough capacity. The alternative method of chemically concentrating the toxic substances and burying them with the high level waste appears highly inadvisable at this time in view of the many unsolved problems associated with the high level waste disposal.

Anyway, some quick decision is urgently needed, or else the total volume alone will preclude any action we might later wish to take: As of 1970, there were more than 8×10^7 tons of uranium mill tailings, corresponding to ~10^3GW(e)y of electrical energy, occupying $8.5 \times 10^6 m^2$ in the U.S. (13).

8) Q: Coal also contains uranium and hence thorium-230. How large are the health effects committed by it?

A: The average uranium concentration of coal is $\sim 10^{-6}$ gram uranium/gram coal (= 1ppm). During the generation of 1 GW(e)y, 3×10^{6} tons of coal are burned, containing 3×10^{6} gram = 3 tons of uranium. As we saw before, 1 GW(e)y of nuclear electric energy required mining 162 tons of uranium. Hence, ~60 times more thorium-230 is set free in the nuclear fuel cycle. From this we estimate the health impact to be ~7 deaths/GW(e)y from thorium-230 and its daughters set free by burning coal, which is minor relative to the other health effects of coal (most of this radioactive health effect can also be eliminated by burying the ash which contains most of the uranium and its daughters).

9) Q: But what about the uranium-238 in the coal? It will act as a source of thorium-230 for times extending for billions of years.

A: The activity of the thorium-230 set free by burning coal follows the exponential time dependence shown in Fig. 1, except that, per GW(e)y, the scale on the vertical axis will be 50 times smaller. The uranium in the ash, however, will cause the thorium activity to remain constant for the order of a billion years, since the decaying thorium-230 is constantly replenished by the uranium-238. Of course, the same problem will be encountered with the uranium-238 presently stored at the nuclear fuel enrichment plant, unless ways are found of either burning it in a breeder, or else disposing of it safely.

10) Q: Clearly, many of our activities will influence the well-being of future generations, in a negative as well as in a positive way. Why focus on one single aspect, whose detrimental effects are spread over hundreds of thousands of years and hence are highly dilute?

A: The purpose of this paper was merely an attempt to rectify two misconceptions. The way in which these facts should influence our decisions is an entirely different question. It is to be hoped, however, that our concern about the long-range commitment inherent in nuclear energy should open our eyes to other, and potentially far more serious threats for future life on our planet - for instance, the threat of a man-made change of the climate.

Let us return to the question of whether the radon effects should really be considered "dilute". The following calculation may help to visualize the magnitude of the health effects we are committing by not properly disposing of the mill tailings: According to a frequently quoted forecast of the expansion of the nuclear industry, the cumulative amount of natural uranium required in the U.S. to fuel its reactors between 1973 and 2000 is approximately 2×10^{6} tons (14), even if breeder reactors become available as early as 1990. Breeders can burn uranium-238 and hence use the uranium far more efficiently. 162 tons of uranium commit, through the thorium-230 in the mill tailings, a total of 396 deaths worldwide, or a constant number of 0.0036deaths every year for times of the order of 10^{4} years, as we saw above. Hence, the 2×10^{6} tons uranium needed to supply the U.S. nuclear energy during the next twenty-five years will result in a commitment of ~48 deaths per year, every year, for the coming tens of thousands of years.

Conclusion

Based on the "Environmental Analysis of the Uranium Fuel Cycle" published by the U.S. Environmental Protection Agency, we have shown that the two standard claims made by proponents of nuclear energy are indeed untenable: As far as health effects and the amount of waste is concerned, nuclear energy is at least as bad as coal. The radon hazard in itself is no catastrophe for nuclear power, because we can, in principle, bury the tailings. What is disturbing, however, is that for such a long time the health effects committed by the thorium-230 have not received their proper attention. Consequently, we must ask ourselves, how many other serious threats to the health of ourselves and our descendants may still be unknown? This question should not be restricted to nuclear energy; it is, however, undeniable that an industry which is developing and expanding as rapidly as the nuclear industry, must be particularly carefully scrutinized.

The initial stimulus to explore this matter resulted from the probing question by my colleague, David M. Lee. Much of the background study was done with the support of a fellowship by the John Simon Guggenheim Memorial Foundation, which is gratefully acknowledged. I also wish to thank Dr. N. S. Nelson from the Environmental Protection Agency for his advice.

Appendix

Model Calculation of the Health Impact

The model tailings pile contains the mill tailings from the ore mined to produce 159 GW(e)y of electrical energy. Its surface area is $a = 1\ \text{km}^2$, its radon emission rate is $r_{pile} = 500 \times 10^{-12}$ Curie/m^2 sec (12). From this, the projected health impact rate is $dF_{Rn}/dt = (60 \times 0.95 =) 57$ deaths/159GW(e)y)/100 y. In order to verify this crucial number, on which the conclusions in the text are based, we use the following simple model for the distribution of the radon gas through the atmosphere. As the gas escapes from the pile, it immediately distributes itself uniformly over the conterminous U.S. (area $A = 7.7 \times 10^6 \text{km}^2$), to which it remains confined as it decays. The natural background radon emission rate is of the order of $r_{nat} = 10^{-12}$ Curie/m^2 sec (15). This emission rate gives rise to a ground level atmospheric radon activity of $\rho_{nat} \approx 10^{-10}$ Curie/m^3 (16). In our model, the emission rate from the pile will cause the following average ground level radon activity:

$$\rho_{pile} = \frac{r_{pile}}{r_{nat}} \frac{a}{A} \rho_{nat} = 6.5 \times 10^{-15} \text{ Curie/m}^3. \qquad (1)$$

The EPA report lists the conversion factor d/ρ from radon concentration in the atmosphere to dose rate to the critical portions of the lungs (17):

$$d/\rho = (4 \times 10^{-3} \text{rem/year})/(10^{-12} \text{ Curie/m}^3). \qquad (2)$$

Hence, the activity resulting from the pile causes the bronchial population dose rate

$$R_{Rn} = 2 \times 10^8 \ \rho_{pile} \ d/\rho = 5.2 \times 10^3 \text{ man rem/year}. \qquad (3)$$

The BEIR report (18) has determined the conversion factor from bronchial population dose to lung cancer fatalities, and we use their value as used in the EPA report (19):

$$\frac{\text{lung cancer fatalities}}{\text{bronchial population dose}} = \frac{50 \text{ deaths}}{10^6 \text{ man rem}} \qquad (4)$$

From this and from R_{Rn} we compute the health impact rate of the pile radon as

$$(dF_{Rn}/dt)/\ W = (0.26\ \text{deaths}/159\ \text{GW(e)y})/\text{y}, \quad \text{or}$$

$$= (26\ \text{deaths}/159\ \text{GW(e)y})/100\ \text{y}.$$

The agreement with the value derived in the EPA study, (57 deaths/159GW(e)y)/100y, is encouraging, although the closeness is probably fortuitous to some degree. Contrary to what one might suspect, though, the confinement of the radon to the U.S. is not too unrealistic, because the population density of the U.S. is rather close to that of the Northern Hemisphere ($2 \times 10^8/77 \times 10^6\ \text{km}^2 = 26\ \text{km}^{-2}$ vs. $3.5 \times 10^9/2.6 \times 10^8\ \text{km}^2 = 14\ \text{km}^{-2}$. Hence, as we increased the radon density in our model by restricting the gas to the U.S., we simultaneously decreased the exposed population by the same factor, which leaves the population dose unchanged. Still, our model suffers from not considering the radioactive decay as the radon gas spreads from the mill tailings pile, but the error introduced by this simplifying assumption appears to be small: with a modest windspeed of 10mph the radon will travel ~1000 miles during its half-life (3.8 days).

The most uncertain step in the calculation of the health impact is the conversion from the atmospheric radon concentration to the bronchial dose rate (17). It depends critically on the thickness of the mucus layer and the cells which the α-particles have to penetrate before reaching the basal cells of the bronchial epithelium believed to be the critical biological target (20). As a control, we calculate the incidence rate of fatal lung cancers expected from the natural background radon emission, using the conversion factor used by the EPA (d/ρ, eq. (2)). From this we obtain

$$R_{Rn,nat} = 2 \times 10^8 \frac{d}{\rho}\ \rho_{nat} = 8 \times 10^7\ \text{man rem/year}, \qquad (5)$$

as the bronchial population dose rate to the present U.S. population. Using the conversion factor from dose to fatalities (eq. (4)), we obtain the fatality rate from natural background radon:

$$\frac{dF_{Rn,nat}}{dt} = R_{Rn,nat} \cdot \frac{50\ \text{deaths}}{10^6\ \text{man rem}} = 4{,}000\ \text{deaths/year}. \qquad (6)$$

This is ~8% of the present rate of fatal lung cancer occurences (~50,000/year), a somewhat large but probably not unreasonably large fraction.

To summarize, the crude estimates presented in this appendix yield results whose orders of magnitude agree with those obtained in the EPA study. Although these estimates must not be viewed as a simpler way of obtaining the same results, the agreement does show that the order of magnitude of the EPA figures is indeed quite reasonable.

References

1. *Environmental Analysis of the Uranium Fuel Cycle*, Part I - *Fuel Supply*, U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, D.C. 20460. EPA-520/9-73-003-B, issued October, 1973.
2. The health impact of other modes of energy production, such as the burning of coal, is determined in an analogous manner.
3. The importance of the environmental radiation dose commitment for the determination of the health impact of nuclear energy has been emphasized by the Environmental Protection Agency for some time. See, for instance, A.C.B. Richardson, "The Historical Development of Concepts of Radiation Dose Commitment", paper presented at the Symposium on Population Exposures, Oct. 21-24, 1974, Knoxville, Tennessee, and "Environmental Radiation Dose Commitment: An Application to the Nuclear Power Industry", U.S. Environmental Protection Agency, EPA-520/4-73-002, Feb. 1974.
4. "Biological Effects on Populations of Exposure to Low Levels of Ionizing Radiation" (BEIR report), National Academy of Sciences, Washington, D.C. 1972.
5. L.A. Sagan, "Human Costs of Nuclear Power", Science 177, 487 (1972) and "Health Costs Associated with the Mining, Transport, and Combustion of Coal in the Steam-electric Industry", Nature 250, 107, 1974; B. L. Cohen, "Perspectives on the Nuclear Debate", Bull. Atomic Scientist 30, 35, (Oct. 1974); Richard Wilson "Kilowatt Deaths", Physics Today 25, 73, (Feb. 1972), and Richard Wilson and William J. Jones, "Energy, Ecology, and the Environment", Academic Press 1974, in particular p. 351.
6. A common mistake is that of determining only the health costs resulting from the radiation dose rate absorbed during the time in which the power P is generated, which corresponds to the "annual installment payment" mentioned in the text. Although this method includes the accumulation in the biosphere of previously generated isotopes, it ignores the effects of the long-lived isotopes, whose health effects are spread over hundreds of years and longer. In the method used in the text, which is based on the environmental radiation dose commitment, all these effects are included, regardless of the time during which they will occur.

7. Ref. (1), page 21 ff.
8. In ref. (1), page 71 and Table 2-17, the number given is 200 instead of 60. It had been derived with a simple model of the atmospheric distribution of the radon; furthermore it was assumed that the U.S. population would grow linearly with time from 205 million in 1970 to 300 million in 2020, and would stabilize at this level, while the world population would grow with a rate of 1.9% (doubling time 37y) during the entire period. The number of health effects quoted in the present text is taken from a recent communication by Dr. W. H. Ellett, Acting Chief of the Biophysics and Analysis Branch of the EPA. It is based on a more sophisticated model of the atmospheric distribution; assuming a constant U.S. population of 208 million, 32 health effects are expected in the U. S. over the next 100 y. Based on the present world population, the health effects outside of the U.S. boundaries are estimated with this model to be comparable to those occurring within the U.S. boundaries. If a population growth rate equal to that used in the EPA study (ref. 1) were included into this more recent computation, we estimate that the health effects in the U.S. would increase to ~44, and in the rest of the world to ~80, thus increasing the number used in the text by roughly a factor of 2. This uncertainty should be kept in mind in the rest of this paper. See also ref. 9.
9. In this extrapolation as well as in the following calculations we have assumed the U.S. and the world population to remain constant (208 million and 3.5 billion, respectively). Any increase of the steady state population would result in a proportionate increase of the number quoted in the text. For example, were the U.S. to stablize at 300 million, and the world at 10 billion, the health impact would increase to ~880 deaths/GW(e)y.

10. The population dose commitment for a population of 3.5×10^9 people resulting from 3.5×10^5 Ci Kr-85 per GW(e)y can be obtained from the UNSCEAR report "Ionizing Radiation, Levels and Effects", Report of the United Nations Scientific Committee on the Effects of Atomic Radiation, United Nations, 1972, Vol. 1, Annex A, Tables 75, 55, and 22: 62 man-rem/GW(e)y for whole body, and 75 man-rem/GW(e)y for gonadal irradiation. With the dose to health effect conversion factors listed in ref. 1, Part III - Nuclear Fuel Reprocessing, Appendix D (for lung cancers, other fatal cancers, and serious genetic effects), these dose commitments translate to 3×10^{-2} serious health effects/GW(e)y, over 10^4 times smaller than for radon. Because of the short half-life of Kr-85, however, the initial rate with which these effects are caused is 2×10^{-3}/GW(e)y/y, almost as high as those for radon.

11. Ref. (1), page 61, Table 2-13.

12. Rev. (1), page 57. In the EPA calculation it was assumed that 23% of the radon generated in the pile would be free to diffuse through it, while the rest remained trapped within the particles of the mill tailings (23% may in fact be too low). Of these 23%, again only 23% would make it to the surface of the 5 meter thick pile before decaying. This means that only 5% of the radon generated in the pile make it to the surface, causing the radon emission rate $r_{Rn} = 500 \times 10^{-12}$ Curie/m^2 sec used in the EPA study, and also in the appendix of this paper. The shielding effect referred to in the text is that caused by the diffusion through the pile, i.e. the second 23%.

13. Ref. (1), page 51.

14. "Nuclear Power Growth" 1974-2000, United States Atomic Energy Commission, WASH-1139 (74), Washington, D.C., Feb. 1974, page 3.

15. Ref. (1), page 58.

16. UNSCEAR report, Vol. I, Tables 12 and 13, pages 79 and 80. ρ_{nat} varies considerably between different locations, and also varies with time.

17. Ref. (1), page 70. For a detailed discussion of the radon-222 dosimetry, see pages 63 ff, also ref. 15, pages 33 ff.

18. Ref. (4), page 150.

19. Ref. (1), page A-18, Table A-11.

20. Ref. (1), page 63 ff, and N. S. Nelson, private communication.

Table I

Decay series of uranium-238, which constitutes 99.3% of the natural uranium. $n_{o,i}$ is the number of nuclei mined in order to obtain enough uranium-235 for the generation of 1 GW(e)y of electrical energy. No allowance has been made for the uranium-235 which is presently not extracted at the isotopic enrichment plant, which is approximately 33% of the uranium-235 sent to the reactor (see Wilson and Jones, ref. (5), page 348), since it is assumed that this uranium-235 (340 kg) will eventually also be separated and utilized when the technology becomes available. In secular equilibrium, i.e. after times comparable to the half-life of the longest lived daughter, and provided that the rock has remained undisturbed (leaching etc.) during that period, the activity of all daughters is equal to that of the parent, which is 55 Curie/GW(e)y (except for the nuclei on branches). From this, and the knowledge of the half-lives, one can compute $n_{o,i}$ for all isotopes. This has been done for a few of them. The last column lists the particles emitted during the decay, and their energies.

Table I

Radionuclide i	Half-life $\tau_{\frac{1}{2},i}$	Number $n_{o,i}$	Particleemitted it's energy (MeV)
U^{238}	4.5×10^9 y	4.1×10^{29}	α, 4.3
Th^{234}	24.1 d	6×10^{18}	β, 0.19[(b)]
Pa^{234}	6.75 h		β, 0.51[(b)]
U^{234}	2.47×10^5 y	2.25×10^{25}	α, 4.86
Th^{230}	7.6×10^4 y	7×10^{24}	α, 4.77
Ra^{226}	1600 y	1.46×10^{23}	α, 4.78
Rn^{222}	3.823 d	9.6×10^{17}	α, 5.5
Po^{218}	3.05 m		α, 6.0
Pb^{214}	26.8 m		β, 0.6[(b)]
Bi^{214} (a)	19.7 m		β, >1[(b)*]
Tl^{210}	1.3 m		β, 1.9[(b)]
Po^{214}	1.64×10^{-4} s		α, 7.68
Pb^{210}	21 y	1.93×10^{21}	β, 0.015[(b)]
Bi^{210}	5.01 d		β, 1.2[(b)]
Po^{210}	138.4 d		α, 5.3
Pb^{206}	stable		—

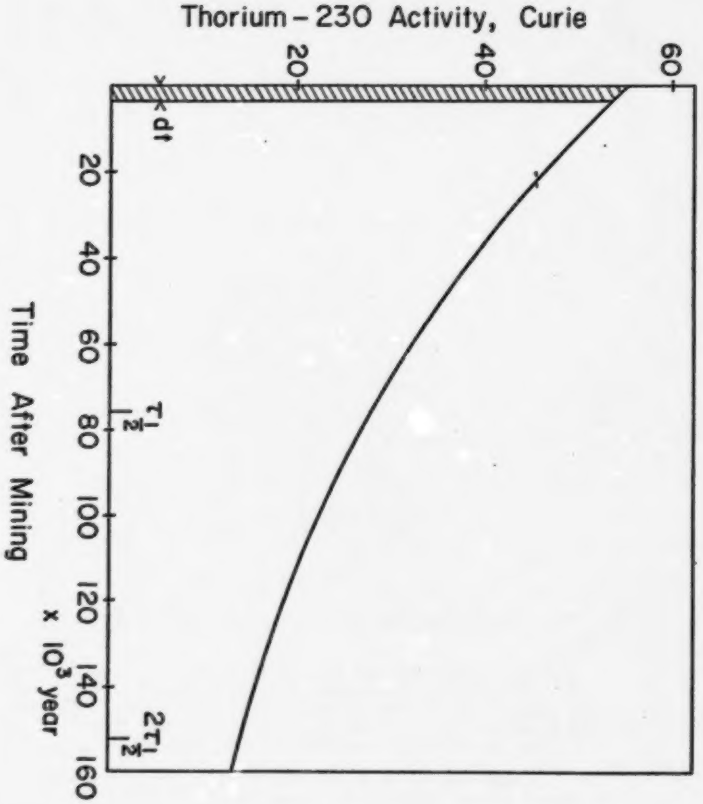
(a) Bi^{214} decays to Pb^{210} either via Tl^{210} or via Po^{214} (branching).

(b) maximum energy of most intense β

* or α, 5.5 MeV

Figure Caption

Figure 1 While mining enough ore to obtain fuel for 1 GW(e)y, 55 Curies of uranium-238 and of each of its daughters are mined. Thorium-230 is the longest-lived daughter that remains with the tailings. It continuously generates radon-222. The curve shown, therefore, is proportional to the radon emission rate from the tailings pile.



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· INDEPENDENT PHI BETA KAPPA ENVIRONMENTAL STUDY GROUP
Elise Jerard - Chairman
115 Central Park West, N.Y., N.Y. 10023
· CITIZENS RIGHTS COMMITTEE
~~22 Charles Street, Hicksville, L.I., N.Y. 11801~~

October 13, 1975

Mr. Russell Train
Environmental Protection Agency
401 M Street S.W.
Washington, D.C. 20460

Dear Mr. Train:

I write as chairman of the Independent Phi Beta Kappa Environmental Study Group, a research society of professionals; and as chairman of the Citizens Rights Committee, with participants in 32 states, also as a member of the Scientists Advisory Committee of Environmental Defense Fund and of the Scientists Institute for Public Information. My work for the doctorate was in biological sciences.

A report in the current Nucleonics Week of a letter to the EPA from Mr. Nossick of the NRC places us squarely on the side of the EPA in relation to full participation in nuclear power regulation and enforcement. It is our position that the EPA's intentions to safeguard the environment and public health have not been thoroughly realized in its draft impact statement nor in its proposed standards but we appreciate fully that hope for the protection of the people of the United States, the present and future members of this society, rests to an awesome extent on the integrity and efforts of the Environmental Protection Agency.

We hope indeed that you will hold a hearing on the problems of the total nuclear cycle and consequent diverse and crucial emissions problems, and that the qualified citizen advocates may speak their minds, while those members of the public who have strong convictions and in some cases neglected evidence, scientific or experimental, may submit statements--the whole to be available in a record for the use of the American people and all others whom it may concern.

We wish to make our own contribution.

We are aware of pressures on the Environmental Protection Agency. But we deplore deeply any influence to make nuclear power promoters of the EPA, even by a largely unsubstantiated statement in the body of an impact statement that nuclear power is essential for several decades.

The one solely protectionist government organization relied on by the citizens of this nation is the EPA which should be solely concerned with environmental and human safeguards and not with promotion of a technology.

In our view the purpose of the abolition of the Atomic Energy Commission will be defeated if the Environmental Protection Agency is routed or weakened in its proper purpose with respect to the most complicated and fateful of environmental issues, that of the nuclear cycle and its impact.

Looking forward to an adequate public hearing,

Sincerely,

Elise Jerard

Elise Jerard, Ph.D.

EJ:eh

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July 18, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Subject: Proposed Standards Concerning Radiation Protection For Nuclear Power Operations

Dear Sir:

Commonwealth Edison Company's personnel have studied the proposed regulations and we hereby submit certain initial comments. Our most important concern is with the need for further study and further rulemaking proceedings. While the proposals at first glance appear workable, careful consideration reveals potential problems with respect to administrative and technical feasibility. To resolve these concerns, we request that the EPA reach its final decision on the record after a hearing in accordance with the following guidelines:

1. All documents utilized by EPA in preparing the proposal and the accompanying statements should be made available for review for an adequate period.

2. All comments submitted in response to the May 29, 1975 Federal Register notice should be made available for an adequate period.

3. If comments from the NRC do not contain definitive information on the possible means of implementing such a standard, the NRC should be requested to supply such comments.

4. A prehearing conference should be held after the documents described in guidelines 1, 2 and 3 have been reviewed. At this conference, parties desiring to make oral statements could be identified and ground rules established for examination and other hearing procedures.

5. A public hearing should be held with an opportunity for oral statements and examination of witnesses. It is imperative that NRC witnesses be available for examination with respect to whether that Agency can implement the regulation as contemplated and with respect to the manner of such implementation.

6. There should be a final opportunity for briefs or further written comments.

It is our understanding that Mr. W. Rowe of the EPA expressed receptiveness toward the concept of a further hearing at a meeting with an Atomic Industrial Forum committee. We do not suggest that such a hearing need be labeled "adjudicatory" with concomitant rights such as discovery among all parties but at least the procedures described above are necessary.

The administrative problems we foresee involve both apportionment among fuel cycle facilities and the determination that no member of the public receives excessive exposure. Until there is clear understanding of the feasibility of implementing the regulation, its viability cannot be determined.

Turning to substantive matters, our review indicates that the dose limits proposed for Section 190.10(a) should be achievable as a result of most, but perhaps not all, operations in the uranium fuel cycle. In this context, problems may arise with direct radiation at certain power plants, with reprocessing plants since there is relatively little actual operating experience, and with multi-unit sites. The regulation may impose a particular problem at sites where new units are added to existing units. We are even more concern about the emission limits of Section 190.10(b). With respect to krypton 85 and iodine 129, we do not believe regulations should be adopted before control technology is successfully demonstrated. The adoption of regulations before such a demonstration inevitably biases future reevaluations. Moreover, the level of economic and environmental costs associated with such treatment cannot

Commonwealth Edison Comp. /

now be determined. With respect to the proposed limitation on alpha emitting transuranics, the infinitesimal release limits contemplated require extremely careful evaluation. Measurement is extraordinarily difficult at such low levels and, in view of measurement uncertainty, the level of treatment necessary to assure compliance may yield substantial effluent control and waste management problems. Each of these matters and the adequacy of available data must be investigated.

In a hearing such as we have requested, we would expect that the adequacy of the EPA's analysis of the technical feasibility and economic reasonableness of control mechanisms would be fully explored and the questions outlined above resolved.

Very truly yours,

RLBolger
R. L. Bolger
Assistant Vice-President

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July 28, 1975

Director
Criteria and Standards Division (AW 560)
Office of Radiation Program
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Subject: Standards for Environmental Radiation Protection for Nuclear Power Operations, 40 CFR Part 190, Proposed Federal Register May 29, 1975

In response to the invitation in the Federal Register May 29, 1975, the American Mining Congress hereby submits the following comments on proposed environmental standards for the nuclear fuel cycle, 40 CFR Part 190. The American Mining Congress is a national trade association of the mining companies that produce most of the nation's metals and industrial, agricultural and other minerals, including the uranium mining and milling firms responsible for most of the uranium oxide production in the United States.

The American Mining Congress objects to the proposed regulations, particularly as to their application to the uranium milling industry. These objections are based on the analysis of EPA's proposed standards and the referenced documents cited in support of this proposal, prepared by Dr. Robley D. Evans for the American Mining Congress. A copy of Dr. Evans' letter of July 18, 1975 is enclosed and is included as a part of the AMC statement.

We will appreciate a careful review of these comments.

Sincerely,

J Allen Overton Jr.
J. Allen Overton, Jr.
President

Enclosure

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Robley D. Evans
4621 East Crystal Lane
Scottsdale, Arizona 85253

July 18, 1975

Mr. J. Allen Overton, Jr., President
American Mining Congress
1100 Ring Building
Washington, D. C. 20036

Subject: EPA's proposed new 40CFR190

Dear Mr. Overton:

This is to confirm and summarize my previous reports to Mr. Johnson particularly with respect to the impact of the proposed rule 40CFR190 on uranium mills.

Reference will be made to the EPA's discussion of the proposed rule as published in the Federal Register for May 29, 1975, pp. 23420-23425 (hereafter called "FR"), to EPA's "Draft Environmental Statement: Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle" (hereafter "ES") dated May 1975, to their "Environmental Analysis of the Uranium Fuel Cycle, Part I - Fuel Supply", EPA-520/9-73-003-B, dated October 1973 (hereafter "EA"), and to the BEIR Committee's report dated November 1972, (hereafter "BEIR") referred to on FR page 23420, column 2, and used by EPA as the primary basis of their estimates of health effects.

The application of the present proposed rule 40CFR190 to uranium milling is discussed mainly in the middle paragraph of FR p. 23422, column 1. The EPA notes that the impact on populations due to off-site effluents from uranium milling should generally be small because of their "predominantly remote locations and lack of widespread dispersion.". The governing rule for uranium mills would be only that part of para. 190.10(a), FR p. 23424, which specifies a maximum annual dose equivalent of 25 millirems to any organ of any member of the general public, because milling operations do not contribute significantly to whole-body γ-ray exposures off-site, and they do not generate any radioactive isotopes of iodine which could contribute to a thyroid dose.

Twenty-five millirems per year is a very small dose rate, scarcely measurable with present field or plant instrumentation. It is less than cosmic radiation at sea level in the United States, and corresponds roughly to the increase in cosmic radiation which

takes place between sea level and 6000 ft. elevation. It is less than the normal gamma-ray background in anybody's back yard. It is comparable with the gonadal irradiation by the potassium-40 found in all normal human muscle tissue.

There appear to be major inconsistencies between EA, ES, and 40CFR190, with respect to releases from mills, which should be clarified by EPA before adoption of 40CFR190, especially if EA is ever to be referred to by NRC for guidance in evaluating compliance with 40CFR190.

The major unresolved problem with respect to mill effluents is as follows. Paragraph 190.10(a) of 40CFR190 reads in part, "The annual dose equivalent shall not exceed ... 25 millirems to any other organ of any member of the public ...". By "any member of the public" I would understand, under the definitions in 40CFR190, Subpart A, paragraph 190.02(c) and (d), any "off-site" location. To me, this means that the 25 mrem/yr applies at the plant boundary, i.e., it's a "fence post value". This would be in accord with EPA's remarks about protection of individuals who live near a site boundary (FR p.23421, column 2), rather than averaging over a population area.

Dosimetrically the organ which is primarily at risk from airborne mill effluents is the lung. The skeletal and whole-body doses from water effluents are judged to be negligible compared with the lung dose wherever reasonable care is taken of waste water (e.g., EA, pp. 36-37). Regarding mills, the paragraph on mills in FR p. 23422 observes that the impact on populations due to off-site effluents should be small. The implication is clear that EPA expects that mills would have an easy time complying with 40CFR190.

Turning to the ES document of May 1975, this reassurance regarding mills such as Humeca, Highland, and Shirley Basin is found in Table 6 on page 54 and in the middle paragraph on page 57, where "... in the general environment ..." "... relatively small doses are projected to the lung and bone at mills ...". Note that Table 6 gives comfortably small dose-equivalent values, (misnamed "exposure"), but does not say where they apply. Possibly, from the text on page 57 they apply "in the general environment" (not quantitatively defined) rather than at the fence post.

The October 1973 EA document carries none of these assurances. This earlier EPA analysis considers a hypothetical "model mill" (p. 24) which annually processes 600,000 metric tons (MT) of ore and produces 1,140 MT of yellowcake, therefore containing 1000 MT of uranium element. The presumed airborne releases of U, Ra-226, and Th-230 from this mill are tabulated on p. 27. These seem to me to be incredibly small. For example, take the 0.1 Ci/yr release of uranium. Because of EPA's definition of a Ci of U (EA p. A-1) 1 MT of U is about 0.67 Ci. Thus the airborne annual release of U postulated is 0.15 MT, which is only 0.015% of the annual output of U. Aside from a small percentage of U left in the tailings or process water, this is a recovery of greater than 99.98%. The EPA describes dust control measures on EA pp. 40-41 and develops "... an effective system control of about 99%.". That's not 99.98%. The EPA's waterborne effluent control measures are described on pp. 44-50, and are also rated as giving less than 0.1 Ci U (p. 34) or 0.015% release from the site.

From these tiny airborne releases, EA then introduces a long series of ad hoc assumptions regarding lung dosimetry, which lead to a dose-equivalent of 450 mrem/yr to the lung at the plant boundary (EA p. 36 and p. A-20). On page 72 they call this the dose to "individuals that might live within 1 km of the plant". That's not "less than 25 mrem/yr". This lung dose from their "model mill" would seem to be in severe violation of the proposed 40CFR190. The skeletal dose attributed to drinking 2 liters per day of their postulated water released at the plant boundary is 13 mrem/yr (p. 37).

I suggest that EPA should clarify the apparent conflict between their 40CFR190 25 mrem/yr to any organ of any member of the public, and their estimated lung dose of 450 mrem/yr at the plant boundary of the "model mill". Both of these postulates cannot be simultaneously correct.

It may be noted that in several places the BEIR report points out that its use of a linear nonthreshold model at all dose-rates and all dose ranges is not based on radiobiological findings but rather is used as the only mathematically "workable approach to numerical estimation of risk in a population" (e.g., BEIR pp. 88, 89). The linear extrapolation from the dosage domain in which radiobiological effects are actually observed down to the dosage domain of radiation protection standards is often by a factor of more than a million. The extrapolated incidence of radiobiological effects at the level of the prudent radiation protection standards have been viewed as upper limits, since the introduction of the linear nonthreshold model for mathematical convenience in assessing dose commitments from atmospheric weapon tests by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) in

1958. The BEIR report's extrapolated value for this maximum absolute risk of lung cancer from α-particle irradiation of the bronchial epithelium is (BEIR, p. 150) 1 case/yr per million person-rems. Thus this risk to one individual receiving continuously a fence-post lung dose of 450 mrem/yr for 20 years is 1 in 100,000, a value which is many orders of magnitude below the natural incidence. The EPA's Environmental Analysis translates this lung cancer risk into a "health conversion factor" of 50 events/million person-rems (EA, Table 11, p. A-18) "over a period of years" (EA, p. A-19) without stating how many years. Overall, the EPA estimates the cost to industry of its proposed rule 40CFR190 "to be less than $100,000 per potential case of cancer, leukemia, or serious genetic effect averted", or "less than $75 per person-rem". This translates into 75/100,000 = 750 cases per million person-rem, which would be viewed by many radiobiologists as a very high estimate of the actual potential risk per rem.

Radon and radon daughter effluents are explicitly exempt from 40CFR190 at present (FR p. 23423, col. 1, and p. 23424, para. 190.10(a)). However "The Agency ... has underway an independent assessment of man-made sources of radon emissions and their management" (FR p. 23423, col. 1). The "Environmental Analysis ...", EA, written about 2 years ago devotes much space to the uranium mill tailings problem. Their treatments in EA of radon flux, migration, daughter product disequilibria, and dosimetry contain many serious scientific errors. Major qualitative and quantitative revisions will be required for any realistic evaluation of any process involving radon release, such as the uranium mill tailings piles.

One pretty obvious "suggestion" to EPA, which may apply to some companies which are members of the AMC, is to clarify whether the proposed rules 40CFR190 apply only to the uranium fuel cycle (as stated in Subpart B, para. 190.10, p. 23424) or to any nuclear fuel cycle (as stated in Subpart A, para. 190.01).

With best wishes.

Cordially yours,

Robley D. Evans.

RDE:mms

Robley D. Evans

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September 15, 1975

Director
Criteria and Standards Division (AW 560)
Office of Radiation Program
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Subject: Standards for Environmental Radiation Protection for Nuclear Power Operations, 40 CFR Part 190, Proposed Federal Register May 29, 1975

By letter of July 28, 1975, the American Mining Congress submitted its comments on the proposed environmental standards for the nuclear fuel cycle, 40 CFR Part 190, published in the Federal Register May 29, 1975. The comments and objections were based on an analysis of the proposed standards prepared by Dr. Robley D. Evans.

The notice in the Federal Register August 15 extending the time for comment to September 15, 1975 has provided Dr. Evans with the opportunity to prepare additional comments on the proposed standards based on further studies of the subject matter. The American Mining Congress hereby transmits a copy of Dr. Evans' letter of September 10, 1975 as further objections by the AMC to the proposed regulations.

Your careful review of this material will be appreciated.

Sincerely,

J. Allen Overton, Jr.

J. Allen Overton, Jr.
President

Enclosure

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ROBLEY D. EVANS
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September 10, 1975

Mr. J. Allen Overton, Jr., President
American Mining Congress
1100 Ring Building
Washington, D. C. 20036

Subject: Additional comments on EPA's proposed new 40CFR190

Dear Mr. Overton:

The EPA having provided an extension of time (F.R. 40, 34417) for comments on 40CFR190, I would like to make the following supplement to the comments in my letter to you dated July 18, 1975.

In the third paragraph of that letter I assumed with EPA that "... milling operations do not contribute significantly to whole-body γ-ray exposures off-site...". However, one should consider the fact that near some older operating mills and inactive mills windblown particulates from the mills and especially from their associated tailings piles will have created local areas of higher than normal γ-ray background.

The possible impact of windblown particulates on the 25 mrem/yr provision in 40CFR190 has come to mind because I have had the opportunity this week to study portions of ORNL-TM-4903, Vol. 1, "Correlation of Radioactive Waste Treatment Costs and the Environmental Impact of Waste Effluents..." by M. B. Sears et al., also to examine some γ-ray survey data by the Colorado Department of Health, and to recall some of my own experiences while doing γ-ray surveys around homes in Grand Junction with the C.D.H. several years ago. A good many homeowners were convinced that a rich admixture of tailings sand in their gardens did wonders, especially for the roses, and γ-ray levels of 0.1 mR/hr or above were not uncommon for gardens.

The ORNL document states (on page 189) that "Both EPA and AEC-Regulatory have taken soil samples in the vicinity of tailings piles. No detectable increase has been noted in the off-site activity except where there has been visible migration of sand dunes.". However, scintillometer γ-ray surveys by C.D.H. personnel do tend to show far-from-pile γ-ray values such as 0.015 to 0.020

mR/hr but γ-ray values more in the domain of 0.02 to 0.03 mR/hr at distances of a few blocks from the tailings. These small differences are of no radiobiological consequence. However, the 25 mrem/yr provision of 40CFR190 corresponds to an average exposure rate of less than 0.003 mR/hr. Hence an elevation from 0.02 to 0.03 mR/hr corresponds to more than 3 times the 25 mrem/yr of 40CFR190 for planned releases.

Table 9.27 (on page 250) of the ORNL document gives some γ-ray exposure levels on the tailings pile and at an unstated but remote distance from the tailings for 4 well-known tailings piles, but unfortunately gives no γ-ray levels at distances such as 1/4 or 1/2 mile.

The entire matter of present γ-ray levels merits detailed study before any regulation at such low differential levels as 0.003 mR/hr is enacted. Indeed it may be permanently hopeless to identify locations near mills and tailings piles where new depositions of windblown particulates elevate preexisting local levels by 0.003 mR/hr.

Further, because a 20-year life is inherent in the planning of new mills, the future annual windblown particulate deposition of fixed activity (not removed by rain, etc.) could only correspond to 1/20th of 0.003 mR/hr or 0.00015 mR/hr per year, which simply cannot be measured reliably against a cosmic ray level of 0.006 mR/hr and an inhomogeneous local γ-ray level of the order of 0.01 to 0.02 mR/hr. Such a regulation would be unenforceable.

It may be timely to recall how small the proposed 25 mrem/yr is, as was mentioned briefly in the 4th paragraph of my letter of July 18, 1975. It is well known that no radiobiological effects have been observed in the populations of Guarapari, Brazil, and of the Kerala Coast of southwest India, who have lived for many generations on monazite sand, where the annual γ-ray exposure of some individuals exceeds 2000 mR/yr, or an average continuous level of about 0.23 mR/hr. On the Kerala Coast the epidemiological study involved a population of 13,000 households, involving 70,000 persons, and included over 13,700 pregnancies in over 2400 married couples. More than 10,000 personal TLD dosimeters were worn and showed that some 25% of the households experienced annual exposures exceeding 500 mR, 8.8% exceeded 1000 mR, and 1.1% exceeded 2000 mR. No epidemiological difference could be found between the residents of the Kerala Coast and those of Bombay where the total annual background radiation is about 100 mR.

The basis for the choice of 25 mrem/yr in 40CFR190 is not self-evident. Would it be reasonable to continue, instead, with the so-called "Surgeon General's action levels", (ltr. Dr. Paul Peterson to Dr. Roy Cleere, July 27, 1970) taking the lowest of the 3 well-known brackets, namely 0.05 mR/hr above background, as the exposure level below which no remedial action is indicated.

In Summary:

At older mill sites there are elevated γ-ray levels around both operating and inactive mills and tailings piles, created by windblown particulates, and exceeding 0.003 mR/hr (25 mrem/yr), but generally not exceeding the Surgeon General's "no remedial action level" of 0.05 mR/hr above background. It is neither feasible nor radiobiologically necessary to decontaminate these areas.

An annual fixed deposition of airborne dust which would not exceed 25 mrem/hr of γ-ray exposure in its 20th year would have to be at the rate of only 0.00015 mR/hr per year. This could not be measured reliably. Such a regulation could not be monitored or enforced.

The Surgeon General's "no remedial action level" of 0.05 mR/hr above background is suggested in place of the 25 mrem/yr of 40CFR190.

The geographical distribution of γ-ray exposure levels in towns with old mills invites much more detailed study before any numerical limitations on new depositions are adopted.

Local variations and seasonal variations will far exceed 25 mrem/yr (0.003 mR/hr), whereas only persistent increases in individual local values could be interpreted as related to milling and tailings management.

Sincerely yours,

Robley D. Evans

Robley D. Evans

RDE:mms

NFS
Nuclear Fuel Services, Inc. 6000 Executive Boulevard, Suite 600, Rockville, Maryland • 20852
A Subsidiary of Getty Oil Company
(301) 770-5510

July 28, 1975

Director, Criteria and Standards
Division (AW-560)
Offices of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Re: Federal Register Notice, May 29, 1975, P. 23420

Gentlemen:

Nuclear Fuel Services, Inc. has reviewed the changes proposed to 40 C.F.R. 190 as published in the Federal Register on May 29, 1975 and offers the comments and suggestions attached hereto. Our review and comments also include the "Draft Environmental Statement, Environmental Radiation Protection Requirements For Normal Operations of Activities in the Uranium Fuel Cycle: and the supporting EPA documents entitled "Environmental Analysis of the Uranium Fuel Cycle, Parts I through III."

Pursuant to the referenced notice, we also at this time wish to indicate our desire to participate in any public hearing on this proposed rulemaking. NFS will continue its review of this matter and at the time of such hearing, NFS would intend to elaborate or supplement on the enclosed comments.

Very truly yours,

J. R. Clark, Manager
Environmental Protection
and Licensing

JRC:jm
Enclosure

NFS' COMMENTS AND SUGGESTIONS RELATIVE TO THE PROPOSED CHANGES TO 40 C.F.R. 190 AND THE SUPPORTING DRAFT ENVIRONMENTAL STATEMENT

JULY 24, 1975

NUCLEAR FUEL SERVICES, INC.
ROCKVILLE, MARYLAND

A. BASIS FOR THE PROPOSED STANDARDS

1. Irrespective of the significance of the radioactive discharges from the commercial uranium fuel cycle, the proposed standards would apply to only a small component of the national and world-wide discharges of radioactivity. Contrary to the summary statement No. 3a of the Draft Environmental Impact Statement, the proposed standards will not "limit the contamination of the... national and global environment." The proposed standards apply only to the fuel cycle, including the reactors, for the commercial generation of electric power by light water reactors. It does not apply to and therefore does not limit similar effluents from:

   a. the fuel cycles in 38 other countries of the world which have a commitment to 294,000 net MW_e of power generation, i.e., almost identical to the U.S. commitment.

   b. the military applications of nuclear power in the U.S. and abroad

   c. the nuclear research being conducted in the U.S. by the Energy Research and Development Administration and others

   d. the production, use, transportation and disposal of radioactive by products used in medical and commercial applications

   e. the atmospheric testing of nuclear weapons by France, the Peoples Republic of China and others. Atmospheric weapons testing has been estimated by USAEC(1) to contribute 500 to 5000 Ci/yr of plutonium to the global environment.

   f. the High Temperature Gas-Cooled Reactor (HGTR) and its fuel cycle although according to Page 4 of the DES the HGTR "...is expected to be available for extensive commercial use by the end of this decade."

We do not believe that such a piece meal approach to standard setting satisfies the direction of Reorganization Plan No. 3 which transferred to the EPA the "... explicit responsibility to establish generally applicable (underline added) radiation standards for the environment." We recommend that the proposed standard be withdrawn and a "generally applicable" standard be developed which puts the nuclear industry contribution in proper perspective.

2. The growth of the U.S. commercial nuclear facilities projected by the EPA in Figure 2 of the Draft Environmental Impact Statement appears to be overestimated by about 50% thereby overestimating the "benefits" in the cost/benefit analysis. The growth projections and the attendant cost/benefit analysis should be revised.

3. The proposed EPA standards are based (refer to pages 13 and 15 of the DES) upon the conclusions of the BEIR(2) Report which included in its several conclusions that "... it appears that ... needs can be met with far lower... risk than permitted by the current Radiation Protection Guide. To that extent, the current Guide is unnecessarily high." We believe that the correct context for the interpretation of this conclusion by the National Academy of Sciences is that the commercial nuclear industry has been able to maintain its radioactive effluents well below the releases corresponding to the Radiation Protection Guides. This interpretation about "unnecessarily high" relative to industry performance rather than to safety was also made by NRC in establishing their "as-low as practicable" design objectives for the radioactive releases from light water reactors.(3) We therefore believe that the conclu-

sions and finds of the BEIR Report if considered in their entirety would not justify the proposed standards.

In its advance notice (May 10, 1974) of its itent to propose generally applicable environmental standards for the nuclear fuel cycle, the EPA indicated that "... EPA will reflect AEC's findings as to the practicability of emission control in its deliberation. It should also be noted that the NRC has recently advised(4) the EPA that, since some types of commercial fuel cycle facilities have so little operating experience, it is inappropriate to establish generally applicable standards near the estimated operating capabilities of the technology.

4. The rationale for the proposed EPA standards rests heavily on some of the conclusions of the BEIR Report; however, the National Council on Radiation Protection and Measurements has recently(5) admonished the use of the BEIR Report for revising the Radiation Protection Guides. The differences between the two reports should be resolved in the Final Environmental Impact Statement.

5. The proposed standards (40 C.F.R. 190.10(b)) include limitations on the release of long-lived radionuclides (krypton-85, iodine-129, plutonium and transuranics) from commercial nuclear fuel cycle facilities. A thorough consideration of the development of this proposed limitation indicates that it is based upon two fundamental factors. These are:

   a. the assumed potential health effects of the release of materials are evaluated on a world-wide basis, and

   b. the criterion is that up to $100,000 be spent on emission control to avoid each assumed potential health effect.

   We believe that these two factors are so fundamental to the consideration of any (non-radioactive as well as radioactive) proposed environmental standard that EPA should immediately consider their use in a separate generic environmental impact review.

B. IMPLEMENTATION OF THE PROPOSED STANDARDS

In other proceedings(1), the EPA has recognized that "...when standards are set, they must be capable of being implemented and enforced in a way that is visible, traceable and reportable and can be substantiated in an evidentiary manner in the courts". The following comments on the proposed EPA standards are made relative to the above EPA guidance on standard setting.

1. The annual dose equivalent limits proposed for 40 C.F.R. 190.10(a) are so low as to be not directly measurable. Compliance must be demonstrated by calculation; therefore, for the proposed limits to be rational and enforceable, a specific model must be included in the regulations to transform measured effluents to a computed, annual dose equivalent. We recommend that such a model be:

   a. proposed by EPA,

   b. offered for public comment and

   c. incorporated into the proposed 40 C.F.R. 190 as an Appendix.

   Such incorporation of the compliance model into regulation appears to have precedence in that EPA has included test methods in the Appendices to 40 C.F.R. Part 60 and Part 61.

We believe that the models for computing annual dose equivalents as presented in the three parts of the EPA's "Environmental Analysis of the Fuel Cycle" are neither consistent among themselves nor consistent with those developed, considered and adopted by the NRC in the Appendix I hearings(3).

2. The application, via 40 C.F.R. 190.10, of the annual dose equivalent standard to "...any member of the public" does not appear to be necessarily within the responsibility assigned to the EPA for the establishment of "...generally applicable environmental standards for the protection of the general environment from radioactive material" and may well cause dual and inconsistent regulatory requirements on the operators of fuel cycle facilities. The two areas of probable conflict between EPA and NRC (and/or DOT) would involve:

   a. the individual computed to be maximally exposed to the facility's potential effluents due to his proximity to the facility's site boundary, and

   b. the individual assumed to be maximally exposed to the radiation attendant to the transport of radioactive material.

   We believe that the maximum exposure to any member of the public should continue to be limited by regulatory limitations of Titles 10 and 49 of the Code of Federal Regulations while the maximum exposure to any suitable sample of the exposed population could be limited by the EPA standards as proposed for Title 40 CFR. Such a distinction would be consistent with the Federal Radiation Council's development of the Radiation Protection Guides.

3. Another difficulty in implementing the proposed standard which is not recognized by the Draft Environmental Impact Statement is that many of the present and future commercial nuclear fuel cycle facilities will provide nuclear material and/or services important to the national defense and/or the U.S. balance of payments (via services to foreign utilities). The DES recognizes only benefit to the U.S. public that occurs via the U.S. production of electric power. It would be equitable but difficult to prorate the fuel cycle effluents and off-site doses for those operations which are unrelated to commercial power generation.

4. For fuel cycle facilities such as reactors and reprocessing plants, it may be practical to correlate effluents and the net electrical generation; however, for the front-end of the fuel cycle facilities (such as mills, conversion, enrichment and fabrication) such a correlation is somewhat conjectural. In an expanding industry such as that of nuclear power, the annual operations of the front-end of the fuel cycle have no discernible relationship to the power generated within that year. We conclude that the proposed 40 C.F.R. 190.10(b) will be difficult to implement equitably and rationally.

C. CONTENT OF DES AND PROPOSED 40 C.F.R. 190

In addition to those comments and suggestions made above, NFS offers the following relative to the Draft Environmental Impact Statement and the Proposed Rulemaking.

1. Neither the proposed 40 CFR 190 nor the DES define the term "transuranic" although Part 190.02 includes extensive definitions and Part 190.10(b) would limit "transuranic" effluents. The scientific definition of a transuranic element is any element whose atomic number exceeds 92. The inclusion of a transuranic element definition in Part 190.02 is important because at present the proposed regulation is ambiguous as to whether or not the EPA intended to limit uranium effluents by Part 190.

2. The proposed Part 190.10(b) would limit the discharge of "... alpha-emitting transuranic radionuclides with half-lives greater than one year. This contrasts with the DES Summary Statement No. 3a which indicates that "...proposed standards would limit... alpha-emitting transuranics (half lives 18 years to 2 million years)." We recommend that any such limit on transuranic effluent be applicable only to those whose half-life exceeds 18 years since:

    a. the half-life criterion would be consistent with the Kr-85 half-life (10.7 years);

    b. Pu-236 (2.85 years), which would be impracticable to measure, would be eliminated;

    c. Pu-241 (13.2 years), which is primarily a beta emitter and which often confuses the definition of the term "alpha-emitter", would be eliminated; and

    d. the limitation would be consistent with the technical justifications (Table C.2 of Part III of the "Environmental Analysis"[7]) where it is shown that Pu-241 has only 1/1000 the relative effect of Pu-239 on a per curie basis.

3. The DES Summary Statement No. 3c is that "there are no anticipated adverse environmental effects of the proposed standards." Such a statement is erroneous since it ignores:

    a. the possible effect that unwarranted and impracticable standards will discourage the orderly entry of fuel cycle facilities thus jeapordizing or frustrating both the President's plan for U.S. energy self-sufficiency and ERDA's plan for energy development.

    b. the real inflationary impact of raising the capital for such controls. Section VI.C. of the DES expresses such capital costs in percentages; however, the important aspect is raising the huge capital dollars needed.

    c. the diversion of funds and manpower from the development, implementation and surveillance of environmental standards which could be much more beneficial to the improvement of the human environment.

4. The second paragraph of Section II of the DES implies that the 190.10(a) limits were meant to apply only to radionuclides other than those identified in 190.10(b). This should be clarified.

5. The expressed basis[a] for the proposed Part 190.10(b) is to limit the persistent exposure possibly resulting from radioactive materials which have long half-lives. The EPA evaluated such potential exposure in its "environmental dose commitment" where the potential radiation doses due to the release of radioactive materials were estimated for the 100 years subsequent to the releases. There is no presentation in the DES that supports the position that the potential doses from transuranics and radioiodine effluents beyond the first year are relatively important. Rather there are tabulations[b] presented in the EPA's "Environmental Analysis" which indicate that potential doses from uranium effluents during the years 2 through 100 following release are not significant in comparison to the first year's potential dose. It appears that the EPA's own sensitivity evaluation discredits the importance of the environmental dose commitment and need for some of the limitations on the commercial fuel cycle such as the proposed 40 C.F.R. 190.10(b).

6. As stated in the DES[c], EPA based their proposed standards upon "an analysis of the cost-effectiveness of risk reduction". We believe that their analysis was substantially in error in that:

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a. Page 21, Paragraph 2 of the DES

b. Table 1-2 of Reference 6 and Page C-2 of Reference 7

c. Page 23, Paragraph 2 of the DES

a. it over-emphasizes the potential risk by a series of assumptions and extrapolations such that the conclusions are heavily weighted by the world population (a large absolute number) which counteracts the potential risk (a very small absolute number) due to fuel cycle effluents.(a)

b. the costs of effluent control are, in some cases based upon minimal investigation and developed by inconsistent and invalid methodology.(b)

c. the DES does not consider how the "costs" might be better utilized in reducing health risks.

7. On Page 24 of the DES, EPA appears to indicate that the proposed Plant 190.10(a) was developed under the premise that the environmental risks to individual members of the public should be consistent with the direct benefits accruing to that individual because of the operations causing the risk. We do not believe that such a direct correlation is either appropriate or possible in setting environmental standards. The overall true benefits to the American public of an increased and sufficient source of energy isn't and probably cannot be accurately estimated.

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a. Page 25 of Reference 7 states "...if the calculation is based upon regional effects rather than world effects, the cost effectiveness of all systems except that for the control of actinides is sharply reduced."

b. Note the different models and parameters used for economic analysis in Appendix B, Page 147-150 and Appendix D of References 6, 8, and 7, respectively.

8. The proposed standard of less than 5 mCi of I^{129} per Gw(e)-yr corresponds to about 99.6% retention of the I^{129} that is in produced power reactor fuel. As indicated in Note 3 to Table 3 of the DES, "some uncertainty exists concerning the performance of immediately available systems." We believe that great uncertainty exists that retention factors of 99.6% to 99.9% can be routinely achieved by systems which must be installed and operational by 1983 to comply with Part 190.12(b). We believe that a 98 to 99% overall retention can be routinely achieved and therefore recommend that any standard limitation on I-129 allow at least 40 mCi per Gw(e)-yr. Since the EPA intends (Page 3 of the Proposed Rulemaking) to formally review any such environmental standards every five years, the setting of the limitation of the 40 mCi/Gw(e)-yr level would probably cause minimal interference with orderly development of the fuel cycle but yet allow a period of performance evaluation.

9. The proposed standard limitation on Kr-85 release would require about 90% retention by a fuel reprocessing plant. Such retention is probably eventually achievable but has not been demonstrated on any commercial scale when treating off-gas streams with compositions similar to those at reprocessing plants. It would appear to be premature[a] to require Kr-85 recovery without any demonstration of technical feasibility on a significant scale of operations - especially since the effective date would be 1983 and EPA will formally review any such limitation in 1980.

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[a] See also the NRC conclusion in Reference 4.

10. Notwithstanding the lack of demonstrated, available commercial-scale technology for the retention of Kr-85, the proposed requirement for the recovery of Krypton at the fuel reprocessing plants appears to be counter to the conclusion of the BEIR Report that "...the public must be protected from radiation but not to the extent that the degree of protection provided results in the substitution of a worse hazard..." It must be considered in the cost/benefit evaluation of Kr-85 recovery that:

    a. the exposure of plant workers will be increased,

    b. the storage of large quantities of retained krypton of a single location will involve as yet unevaluated risks,

    c. some of the potential processes for the retention of krypton involve explosive potential and thereby some risk of accidental release of radioactivity.

11. Notwithstanding the lack of demonstrated technology nor the lack of complete evaluation of the potential environmental costs (Items 9 and 10 above), the retention of krypton is not justified as "cost/effective" by the supporting document (Appendix D, Part III of "Environmental Analysis"). As presented, the economic analyses supporting the EPA's proposed requirement for krypton recovery (as well as the other proposed standards) is simplistic, inconsistent and in some aspects invalid. Difficulties with the economic analyses include:

a. It is not clear to why Table D.2 "Estimate of the Economics of a 5 MTU/Day Reprocessing Plant" is germane to the economic analysis of pollution control devices in such a plant. In any event, the Table D.2 is taken from a short course seminar where it was undoubtedly used for illustrative purposes rather than rigorous analysis. Table D.2, for example, assumes a 5 MTU/day reprocessing plant will cost $60-80 million in 1972 dollars where a more realistic estimate is about $500 million in 1975 dollars.

b. It does not appear that any of the cost estimates in Appendices B or D have been escalated.

c. It does not appear that the "control system costs" of Table D.3 includes anything other than the mechanical equipment. The costs of structures for shielding and protection against the significant release of radioactivity subsequent to natural phenomena events is expected to be far greater than the cost of the process equipment.

d. The "first costs" of Table D.3 should include design, engineering, licensing, purchasing, construction, installation, quality assurance and pre-operational testing.

e. For krypton, the control system cost must include the facility for the long-term storage, surveillance and eventual disposal of the recovered krypton and its decay products.

f. It is inappropriate to assume a 40 year economic life-time for a developing control system such as krypton recovery which is employed in an industry such as the nuclear fuel cycle which is subject to frequent regulatory changes.

g. As recognized on Page B-16, the cost of krypton recovery will be significantly more in the existing reprocessing plants than in future plants that might be able to reduce the volumes of off-gases from dissolution.

12. Although the proposed EPA standard does not include limitations on the discharge of tritium or carbon-14, EPA will continue to consider the practicability of such control (page 132 of the DES) therefore, we believe some comments are in order concerning these effluents.

    a. Deep-well disposal of tritiated water received only one sentence of evaluation (page B-22 of Reference 7) in the documents supporting the DES. Since 1) the technology of deep-well is well established in comparison to the other alternative (voloxidation) and 2) deep-well is far less expensive[a] than voloxidation, it would seem that deep-well disposal is worthy of far more serious and extensive study by the EPA. We note that regulation of deep-well disposal is apparently within the EPA's authorized responsibilities.

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[a] EPA estimates are $400,000-$500,000 for deep-well and $31 million for voloxidation.

b. Based upon NFS' experience and testing by EPA(9),(10) at the NFS reprocessing plant, the EPA estimate of 800 Ci H^3 released per tonne of fuel irradiated to 33,000 Mwd/MTU is believed to be 2 to 4 times too high.

c. As indicated in the DES (Pages 82 and 132), knowledge on the extent of the impact of C-14 effluents is currently limited and considerations on the appropriate method of control are just beginning. We concur that the C-14 is worthy of further intensive study; however, we believe that with the meager amount of presently available data it is potentially greatly misleading to display the "potential" world-wide health effects due to C-14 such as was done in Table 1c of the DES. We recommend that 1) C-14 evaluations be eliminated from the FES, 2) EPA in conjunction with NRC and ERDA determine what quantity and form of C-14 really is in irradiated nuclear fuel, and 3) the EPA's "Environmental Analysis of the Uranium Fuel Cycle" be revised to incorporate the results of substantive C-14 investigations.

REFERENCES

1. "Proceedings of Public Hearings, Plutonium and the Other Transuranic Elements, Volume 1", ORP/CSD-75-1, Washington, D.C., December 1974.
2. "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ioning Radiation, National Academy of Sciences - National Research Council, November 1972.
3. "Numerical Guides For Design Objectives and Limiting Conditions For Operation to Meet the Criterion "As Low As Practicable" For Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents", NRC Docket No. RM-50-2.
4. Letter from L.V. Gossick, Acting Executive Director For Operations, U.S. Nuclear Regulatory Commission to R.E. Train, Administrator, U.S. Environmental Protection Agency, Dated, February 25, 1975.
5. "Review of the Current State of Radiation Protection Philosophy", NCRP No. 43, January 15, 1975.
6. "Environmental Analysis of the Uranium Fuel Cycle, Part I, Fuel Supply", EPA-520/9-73-003-B, October 1973.
7. "Environmental Analysis of the Uranium Fuel Cycle, Part III, Nuclear Fuel Reprocessing", EPA-520/9-73-003-D, October 1973.
8. "Environmental Analysis of the Uranium Fuel Cycle, Part II, Nuclear Power Reactors", EPA-520/9-73-0003C, October 1973.

REFERENCES (Con't)

9. "An Investigation of Airborne Radioactive Effluents From A Operating Nuclear Fuel Reprocessing Plant", BRH/NERHL 70-3 Cochran et. al., U.S. Dept. of Health Education and Welfare July 1970.

10. "The Observation of Airborne Tritium As a Source and Environmental Waste Discharge From a Nuclear Fuel Reprocessing Plant, Cochran et. al., EPA Office of Radiation Program, May 1972.

NORTHEAST UTILITIES

DONALD C. SWITZER
EXECUTIVE VICE-PRESIDENT

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203-666-6911

July 24, 1975

Director, Criteria and
Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Comments on Proposed Standards 40CFR190
entitled
"Radiation Protection for Nuclear Power Operations"

We are taking this opportunity (FEDERAL REGISTER notice, May 29, 1975) to comment on the proposed Standards, Title 40, CFR Part 190 entitled "Environmental Radiation Protection Standards for Nuclear Power Operations," and to request the opportunity to participate in a public hearing on the proposed rulemaking.

We have reviewed the Draft Environmental statement that supports these proposed standards. We find that there is a high degree of unwarranted conservatism in the models and assumptions used which result in overly restrictive proposed standards which will have serious financial and operating penalties if they are implemented unchanged. Because of the importance of these proposed standards and the nature of our concerns about them, we therefore respectfully request that the Environmental Protection Agency hold a rulemaking hearing of an adjudicatory nature to permit a proper and more detailed examination by interested parties of the bases for these proposed standards.

We believe that a timely evaluation of existing standards for public exposure to radiation is appropriate and responsive to the concerns of many members of society. This is a sensitive issue and, if the evaluation indicates it, the standards should be so changed. We, however, believe that before such a change is made, a detailed realistic assessment of the total (curie) releases from all sources, their dispersion, the dose to man, and the financial expenditures for the incremental control of the effluents is essential.

THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY

The nuclear industry has recently gone through a long and extensive proceeding on the Nuclear Regulatory Commission's Appendix I to 10CFR50. Detailed technical information was prepared by the Consolidated Utilities Group (of which we were a member) and the NRC for light water reactors on the same subject with the objective of determining the state of the art for effluent control, its costs, and as low as practicable design limits. The final version of Appendix I to 10CFR50, issued May 5, 1975, does demonstrate that a little realism in the models goes a long way in alleviating unnecessary restrictions and at the same time does not compromise public health and safety. We are dismayed to note that the EPA proposed regulations refer to an earlier version of the Appendix I to 10CFR50 that was later changed significantly. The Director should reevaluate these proposed standards in the light of the final version of Appendix I and the spirit of realism that it generated. It is our upinion that the models and assumptions used by the EPA in the proposed standards collectively lead to a degree of conservatism that makes the proposed numerical limits more restrictive by a factor of anywhere from 5 to 10 than if more reasonable assumptions and models were used. The estimated capital costs in equipment per GWe (10^3 MWe) for effluent control systems to meet the proposed standards of \$4.5 x 10^6 (PWR) to \$8.5 x 10^6 (BWR) on a 1972 base are grossly underestimated. Electric utility systems, especially those such as Northeast Utilities with operating multi-unit sites and a heavy future commitment for nuclear power are concerned with the impact on ratepayers of these increased costs for the entire fuel cycle from mining to fuel reprocessing.

Appendix I to 10CFR50 provides in the operating technical specifications for a factor of two increase in operating limits over the engineering design limits, i.e., 10 instead of 5 millirem/year per reactor for the whole body dose from gaseous effluents. This provides for flexibility in operation. For a two-unit site, the operating limit would be 20 millirem in any one year. Since the EPA proposed standard is based on the entire fuel cycle, the contribution from fuel and waste transportation must be added to the nuclear station effluent radiation exposures. Fuel and waste transportation can add a few millirem/year to the individual radiation exposure. Hence the EPA proposed standard of 25 mrem/year to an individual from the entire fuel cycle will thus limit a new site to two reactors. In the case of multi-unit sites (more than two units) the NRC, in implementing these proposed standards, would be forced to severely curtail the flexibility for operation. The consequence of such an action would be that the public would not be provided a dependable source of power.

There are additional concerns with the apparent lack of perspective in the proposed standards and their supporting material and they are listed briefly below:

a) Treating estimated health effects as real instead of potential effects that occur after chronic exposure over a period of 25 to 30 years.

b) Medical sources account for 90% of all man-made exposure, which could be reduced by at least a factor of two with a minimum of control. In comparison, the nuclear industry which you are proposing to restrict accounts for only about 1% of the exposure.

c) The proposed standards should be based on the United States population and on cost-effective dollar values applicable to the United States economy. This would be a realistic and reasonable approach as these proposed standards are obviously not enforceable elsewhere.

d) The costs for long-term storage of radioactive waste from fuel reprocessing should be considered.

Companies of the Northeast Utilities system have direct and indirect ownership interests in a number of nuclear generating plants in New England, including Millstone Unit 1, Connecticut Yankee, Maine Yankee, Vermont Yankee, and Yankee Atomic, which are operating, and Millstone Units 2 and 3, Montague Units 1 and 2, Seabrook Units 1 and 2, and Pilgrim Unit 2, which are under construction or proposed for construction. They thus have a substantial interest in the proposed standards and their effects on existing and proposed plants and sites.

We request that there be adequate opportunity for the discussion of the details of these concerns through the holding of a public rulemaking proceeding and that the companies of the Northeast Utilities system be allowed to participate fully therein.

Very truly yours,

NORTHEAST UTILITIES SERVICE COMPANY

D.C. Switzer

D. C. Switzer
Executive Vice-President

DCS/mr

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July 24, 1975

Director, Criteria and
  Standards Division (AW560)
Office of Radiation Programs
Environmental Protection Agency
Washington, DC 20460

Dear Sir

In accordance with the Atomic Energy Act of 1954, as amended, and Reorganization Plan No. 3 of 1970, The Environmental Protection Agency gave notice in the Federal Register, May 29, 1975, of proposed standards on "Radiation Protection for Nuclear Power Operations" for adoption as 40 CFR Part 190. The intent of the proposed standards is commendable but their implementation is unclear.

The standards will lead to problems of apportionment of dose among various contributors. We are unable to assess the impact these standards will have on individual plants. Since most nuclear power plants are not currently located near mining, milling, or reprocessing facilities, the 25 mrem dose limit could be interpreted as a limit for individual sites. Taking into account 10 CFR Part 50 Appendix I limits, enforcement of the EPA standards could restrict the number of reactors at a site to three. We are concerned about this because some utilities have long-range plans for installation of more than five nuclear units on a single site. It should be noted, in addition, that there are a limited number of acceptable sites available.

The standards do not deal with the problem of future nuclear parks meeting the proposed dose and release limits, merely stating that since no nuclear

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Director, Criteria and
  Standards Division (AW560)

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parks will exist for at least ten years, the standards can be modified in the future to allow for them. By specifically excluding nuclear parks from the standards, EPA makes utility planning for the design, purchase and construction of future nuclear power plants difficult. Further, being denied the opportunity to locate multiple units at a site can be very costly for a utility. One company estimated in 1973 that if it were not allowed to co-locate another unit with two installed nuclear power plants it would involve incremental costs in excess of $70 million to build at a different site.

The proposed standards and their supporting draft environmental statement are based, in part, on the proposed Appendix I, rather than Appendix I as adopted. Since 1971, through four years of hearings on Appendix I, it was clearly shown that the limits for normal operation were calculated doses, not amounts of radionuclides released. If the EPA standards are adopted as written, using curie quantity limits, the NRC will have to amend Appendix I. The end result will certainly cause licensing problems.

It is regrettable that the EPA radiation dose-risk estimates are based solely on the BEIR Report which assumes the no-threshold linear theory. NCRP43 "Review of the Current State of Radiation Protection Philosophy" should also have been considered in setting dose limitations.

With regard to specific limits to I^{129} and Kr^{85}, the standards would impose requirements that cannot be met with today's technology. The supporting report assumes that the technology will be available by 1983 when the EPA standards become applicable.

In summary, the standards are commendable as a societal goal but they do not take into consideration the methodology for their implementation. Apportionment of annual dose equivalent is undefined in the standards.

...continued

Director, Criteria and
Standards Division (AW560)

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Any dose and/or release limits should be applied individually to each part of the fuel cycle rather than to the entire fuel cycle. This would allow Appendix I limits to be imposed on reactors without change.

The standards give no basis for their effective dates. In light of this, and reflecting on the industry's concerns, we recommend that the standards not be promulgated as written. Instead, we recommend that EPA should hold a rulemaking hearing. We understand that several utility companies would like a public hearing to provide an opportunity to question those personnel who developed the standards.

Sincerely yours

W Donham Crawford

W Donham Crawford
President

ph

GEORGIA POWER COMPANY

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ATLANTA

July 25, 1975

Director, Criteria and Standards
Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Re: Proposed 40 C.F.R. Part 190

Dear Sir:

Georgia Power Company welcomes the opportunity to comment on EPA's proposed "Environmental Radiation Protection Standards for Nuclear Power Operations," which were published at 40 Federal Register 23420, May 29, 1975.

Georgia Power Company, a part of The Southern Company system, is a public utility providing electrical service to over a million customers in Georgia. As part of its commitment to meet its service area's growing electrical demand in the most economical manner possible, consistent with other legitimate societal goals, Georgia Power Company plans to rely on nuclear energy for an increasing portion of its generation capacity. As a utility with existing and planned nuclear generating plants, the Company is directly and substantially interested in EPA's proposed regulations.

We note that EPA intends to hold a public hearing on these regulations, and, while we believe a formal adjudicatory hearing would be more appropriate, we do desire to participate, either individually or as part of a group of similarly interested utilities, in whatever hearing is held.

The May 29 Federal Register notice states that single copies of EPA's Draft Environmental Statement on these regulations and an "Environmental Analysis of the Uranium Fuel Cycle" are available upon request. Please send a copy of each of these two documents to my office at your earliest convenience.

Our principal criticism of these proposed regulations relates to the agency's use of a scientifically unproven "linear non threshold dose-effect relationship" which assumes some impact on public health at all levels of exposure to ionizing radiation and an impact proportional to exposure. EPA and Georgia Power both recognize that we live in a world with a natural background of exposure and that serious harm results at man-made exposure levels much greater than background. However, EPA has extrapolated this relatively well-known serious harm-exposure level relationship back to background levels in a linear fashion with no allowance for the human body's possible capability to handle near background levels of exposure. EPA does this even though recognizing "that sufficient data are not now available to either prove or disprove these assumptions, nor is there any reasonable prospect of demonstrating their validity at the low levels of expected exposure with any high degree of certainty." 40 Fed. Reg. at 23420.

EPA's linear non threshold dose-effect assumption, admittedly based on nonexistent scientific foundations, cannot legally stand in light of Ethyl Corporation v. EPA, No. 73-2205, (D.C. Cir., January 28, 1975). In Ethyl, the United States Court of Appeals for the District of Columbia Circuit, over Judge Wright's dissent, invalidated EPA's regulations on lead additives in gasoline because EPA did not have sufficient proof of the "causal connection" between lead emissions and harm to public health. The Ethyl majority wanted to see "a measurable increment of lead to the human body, and that this measurable increment causes a significant health hazard to a substantial portion of the general population." (Ethyl slip opinion at 12). The court in Ethyl would not let EPA make a "reasoned judgment on a border area of scientific knowledge and policy choice" (slip opinion at 11), and it is likely that a court reviewing EPA's proposed Part 190 would reach the same result.

Although the Ethyl case is being reconsidered en banc, there is no such cloud over the similar reasoning and holdings in Reserve Mining Co. v. United States, 498 F.2d 1073 (8th Cir. 1974), application for order vacating stay denied, 95 S.Ct. 287 (1974), final decision allowing Reserve a reasonable time to abate its discharge, 7 E.R.C. 1620 (8th Cir. 1975).

A second objection to the proposed standards is that their limitations on radiation releases apply to the whole fuel cycle on a per gigawatt-year basis. The standards do not assign portions of the limit to any segment of the fuel cycle. As a result, no such segment can determine the standards' impact on its operations. Surely nuclear power plant operators are entitled to know what numerical limits they are expected to meet.

A third objection is to the prospective-only application of the variance mechanism provided in section 190.11. Because an operator of a nuclear power plant may not know ahead of time when a "temporary" or "unusual operating condition" will arise, and since continued operation of the plant may best serve public interest, the variance mechanism should work retrospectively as well as prospectively.

Our final comment regarding EPA's proposed standards is that, notwithstanding EPA's apparent belief that the standards are not inconsistent with Appendix I to 10 C.F.R. Part 50, the EPA standards can be more restrictive than Appendix I, particularly at multi-reactor sites. The substantial effort expended by many highly competent people as part of the Appendix I rulemaking proceeding should not be lightly or inadvertently disregarded by EPA at this point.

There are a number of other potential technical flaws in the proposed regulations, particularly with some of the cost-effectiveness assumptions regarding methods of meeting the proposed standards. Georgia Power Company believes that the best and only appropriate way of considering these potential flaws is in a formal adjudicatory proceeding, and the Company therefore suggests that such a proceeding be undertaken by EPA before finally promulgating these regulations.

Please direct any questions about these comments, as well as notice of any hearings to be held on the proposed regulations, to my office. Georgia Power Company appreciates the opportunity to participate in this rulemaking procedure and urges EPA to give serious consideration to these comments.

Sincerely,

W. E. Ehrensperger

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Senior Vice President,
Power Supply

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July 25, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

On Thursday, May 29, 1975, the EPA published in the Federal Register (FR 75-14017) proposed standards entitled "Radiation Protection for Nuclear Power Operations", 40 CFR Part 190. B&W has reviewed the proposed standards, and we would like to offer the following comments with respect to its implementation.

B&W recognizes that it may not be the province of the EPA to establish how the proposed regulations will be applied to individual facilities or individual sites. However, it does not appear that it is in the best interest of the general public, nuclear industry, or nuclear regulators to establish regulations while the matter is silent on implementation. For this reason, it is recommended the following approaches be considered for incorporation into the proposed regulation:

1. 10 CFR Part 50 Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Practicable' For Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," provides guidelines for control of radioactive materials in gaseous and liquid effluents produced during normal reactor operations, including expected operational occurrences. Appendix I became effective June 4, 1975, and since both Appendix I and the proposed 40 CFR Part 190 are oriented to the same objective, 40 CFR Part 190 should be modified to recognize that a facility complying with Appendix I satisfactorily meets the proposed 40 CFR 190 rather than just stating it as an EPA view.

2. For facilities other than light-water reactors, or all facilities if approach 1 above cannot be used, implementation of the proposed regulations should be delayed until such time as the Nuclear Regulatory Commission establishes corresponding rules for application of the proposed regulations.

3. An alternative to approach 2 would be to issue the proposed regulations as recommendations and not mandatory until such time as the Nuclear Regulatory Commission establishes the necessary corresponding rules.

Director,
Criteria and Standards Division

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B&W recommends that a public hearing be considered so that interested parties can better understand the bases for the proposed regulation. The schedule for public hearing should be such that the participants have time to adequately prepare for it.

B&W appreciates the opportunity to offer these comments.

Very truly yours,

BABCOCK & WILCOX COMPANY

For Kenneth E. Suhrke
Manager, Licensing

KES/db

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July 25, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Attached are our comments on proposed 40 CFR 190.

We appreciate having been given the opportunity to comment.

Yours very truly,

J S Loomis

J. S. Loomis
Head, Nuclear Safeguards and
Licensing Division

JSL/ns
Enclosure
cc: L. E. Ackmann (1/1)
W. A. Chittenden (1/1)
G. F. Hoveke (1/1)
File 1B-4

COMMENTS ON PROPOSED 40 CFR PART 190

While it is accepted that the Environmental Protection Agency (EPA) has been granted the authority to inaugurate the proposed standards, we believe that it is somewhat unfortunate that it has chosen this time to do so. For the past few years, the nuclear industry has been working very hard, together with the Nuclear Regulatory Commission (NRC), in finalizing the implementation of Appendix I to 10 CFR 50. This effort is a continuing one. While the proposed standards do go somewhat beyond the scope of Appendix I, there would seem to be no doubt that its implementation will directly affect the implementation of Appendix I. Since no guidance is given by the EPA for such implementation, the efforts of the past few years may be seriously negated; one questions what further delays in the licensing of new nuclear plants will result. Such delays are clearly not in the national interest.

In basing its cost-benefit analyses solely on the work of the BEIR Committee, the EPA neglects a great body of evidence (including that in the 1972 Report of the United Nations Scientific Committee on the Effects of Atomic Energy - UNSCEAR, and Report 43 of the National Council on Radiation Protection and Measurements) which indicates that estimates of carcinogenic risks based upon an extrapolation of data gathered at high doses and dose rates may be in considerable error.

Furthermore, it would appear to be more appropriate for the EPA to set more general standards, perhaps in terms of the total man-rem to the population per gigawatt-year, as has been done in other countries, than to set dose limits to individuals as proposed in paragraph 190.10 (a). It is felt that such individual dose limits are already adequately covered by Appendix I design criteria requirements.

The wording of paragraph 190.10 (b) would require an apportionment of total Curie discharged from different elements of the uranium fuel cycle. While such an apportionment could be made at one instance in time, the limits so imposed would of necessity change with time as more facilities are built, others are decommissioned or temporarily put out of service, etc. Such a policy will be difficult to implement, and may hamper the increased use of nuclear fuels to provide for our nation's energy needs. In view of the fact that the technology to limit the releases of Kr^{85}, I^{129}, and Pu^{239} to the Curie quantities proposed may not be commercially feasible by 1983, and that other nations are free to release substantially greater quantities of effluents into the environment, the provisions of paragraph 190.10 (b) appear to be somewhat premature, and might be more appropriately proposed following technical evaluation of available technology, and the acceptance of international agreements limiting effluent releases.

PACIFIC GAS AND ELECTRIC COMPANY

PG&E

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July 25, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
U. S. Environmental Protection Agency
Washington, D. C. 20460

Re: Comments on the Proposed EPA Standards Entitled "Environmental Radiation Protection Standards for Nuclear Power Operations"

Gentlemen:

In response to the May 29, 1975 Federal Register Notice (40 F.R. 23420), we have reviewed the EPA's proposed standards entitled "Environmental Radiation Protection Standards for Nuclear Power Operations" along with the related Draft Environmental Statement "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle."

We acknowledge the intent of the proposed radiation standard for the complete nuclear cycle and recognize the EPA's responsibility for setting such standards, as transferred to them from the Federal Radiation Council. However, it is believed that the standard, as written, creates undue administrative and operational difficulties to all individual parts of the nuclear cycle without any significant change in the already minimal environmental impact from the generation of electricity by nuclear power.

Since the standard is written for the uranium fuel cycle as a whole, it is not clear how the curie quantity limits and the single dose limit can be apportioned and implemented for the individual parts of the cycle. Further, the current industry practice for minimizing the environmental impact from nuclear power plants is to use multi-unit sites. Based on current reactor designs, implementation of the new standards may limit the number of reactors per site and thereby increase the overall environmental impact for a fixed installed nuclear capacity by requiring development of additional sites. It is also unclear that the environmental dispersion models used by the EPA to derive these standards are sufficiently similar to the models that the NRC would use to implement these standards to achieve the desired public health and safety considerations.

Based on these uncertainties, we believe that hearings should be held by the EPA to present all background material used to develop these standards and to provide the opportunity for industry representatives to examine the rationale and methods used to develop them.

These comments are submitted with the intent of being constructive and maintaining the present minimal environmental impact of the civilian nuclear power industry.

Very truly yours,

Philip A. Crane,

BALTIMORE GAS AND ELECTRIC COMPANY
GAS AND ELECTRIC BUILDING
BALTIMORE, MARYLAND 21203

ELECTRIC ENGINEERING
DEPARTMENT

July 25, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Subject: Comments on EPA's Proposed Environmental Radiation Protection Standards for Nuclear Power Operations (Federal Register Vol. 40, No. 104, Part II, May 29, 1975)

Dear Sir:

Pursuant to the notice of EPA's proposed environmental radiation protection standards published in the Federal Register, 40 FR, No. 104, Part II, May 29, 1975, the following comments and recommendations are made for your review and consideration:

Summary and Recommendations

1. The proposed standards are unnecessarily restrictive. The maximum dose limit of 25 mrem to the whole body and any organ except the thyroid could prove more restrictive in the case of multi-reactor sites than the guides set forth in Appendix I to 10 CFR, Part 50.
2. The proposed curie limit for Kr-85 will require Kr-85 removal at fuel reprocessing plants. The technology including its cost effectiveness for such a removal has not yet been demonstrated.
3. There is no new evidence of radiation effects calling for changes in the current national radiation protection standards. The EPA's application of the BEIR estimates of risks is scientifically invalid in developing the proposed standards.
4. The comments period should be extended up to September 2, 1975.

We believe that the EPA's proposed action of setting national environmental radiation protection standards would have a significant impact on the nuclear power industry. It would also have a significant impact on the public in their understanding and appreciation of the health risks associated with the environmental radiation exposure from nuclear power operations. It is recognized that nuclear electric power is a vital and indispensable component of this nation's near-term as well as long-term energy supply. In view of this, it is necessary that a thorough review be made of the proposed standards, the draft environmental statement, and reevaluation made of the information contained in the three volumes of the technical report entitled "Environmental Analysis of the Uranium Fuel Cycle."

Within the limited time period allowed by the EPA in its request for comments, it has not been possible for us to complete such a review and reevaluation. Since we would like to submit detailed comments on this subject in time for your consideration, we request you to extend the comments period up to September 2, 1975. In the meantime, we submit some general comments as follows:

The EPA proposed maximum dose limit of 25 mrem to the whole body and any organ except the thyroid could prove more restrictive in the case of multi-reactor sites than the guides set forth in Appendix I to 10 CFR, Part 50.

The proposed curie limit for Kr-85 will require Kr-85 removal at fuel reprocessing plants. The technology including its cost effectiveness for such a removal has not yet been demonstrated.

The proposed standards are certainly unnecessarily restrictive. It appears that in proposing these standards, the EPA has been guided by the philosophy - "if it can be done, it must be done, and it must be legislated." This is a relatively new concept in public health protection from radiation and deserves thoughtful scrutiny. It is a concept which has also appeared recently in public health areas other than radiation and leads to the ultimate goal where all environmental contaminants are maintained forever at zero or near zero. Such a goal has certain attractions to some people who do not count the cost; but the cost must be counted, and it must be paid.

It appears that in developing these standards, the EPA chose to be guided by the NAS-BEIR Committee Report published in November, 1972 and ignored the recommendation of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Report (Ionizing Radiation: Levels and Effects) published at about the same time. While both these reports are based on essentially the same data, different assessments and conclusions have been drawn and different applications have been proposed. Some of these differences are extremely important, particularly the question of the use of the linear hypothesis in risk estimations at low radiation levels and the question of the use of such risk estimates in setting radiation protection standards.

The BEIR Report extrapolated by a factor greater than 1,000 in dose and by factors from 100 million to a billion in dose rate, from the level of observed effects to the levels encountered by the general population and estimated the risks at low doses and low dose rates of low LET radiation. These risk estimates are applied by the EPA in developing the proposed radiation standards.

The body of the BEIR Report, as distinguished from the Summary and Recommendations, indicates the possible factors that might invalidate linear extrapolation as a means of estimating risks at low doses and low dose rates of low LET radiation.

In contrast with the NAS-BEIR Report, the UNSCEAR imposed limitations in its approach to risk estimation and concluded that:

"Estimates of risk per unit dose derived from epidemiological investigations are valid only for the doses at which they have been estimated and they can be applied to a range of doses only if there is a linear relationship between dose and incidence since extrapolations beyond that range may lead to gross errors."

The UNSCEAR Report stressed the uncertainty of extrapolations of available data to low radiation levels, does not attempt such extrapolations, and indicates the need for consistency between conclusions drawn from epidemiological data and established general findings in radiobiology, making a special point in this connection concerning the functional relationship between RBE of high-LET radiation and dose and dose rate. The UNSCEAR Report indicated that the data from Hiroshima, involving mixed gamma and neutron radiations, and the uncertainty of the neutron RBE at low radiation levels, constitutes a strong argument against extrapolation from these data obtained at high doses and dose rates to estimate even upper limits of risk at low doses and dose rates, especially for low-LET radiation.

It is appropriate to state that the NCRP in its Review of the Current State of Radiation Protection Philosophy (NCRP Report No. 43 issued January, 1975) finds no new evidence of radiation effects calling for changes in the current national radiation standards. Furthermore, the NCRP has cautioned governmental policy-making agencies of the unreasonableness of interpretting or assuming "upper limit" estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption. But we regretfully note that the EPA chose to ignore all this, destroying the confidence in the NCRP standards which are surely the most firmly based and carefully conceived.

It is our position that before considering any further restriction of the current radiation protection standards, it behoves EPA to obtain realistic values for risks and benefits for weighing these in decision making. This approach is important in order to avoid the expenditures of large amounts of the limited resources of society to reduce very small radiation risks still further, with possible concomitant increase in risks of other hazards or consequent lack of attention to existing greater risks.

Several scientific committees of the NCRP are currently engaged in reviewing and evaluating the data on effects of radiation on animals and man and analyzing additional evidence that has been adduced since the 1972 UNSCEAR and NAS-BEIR Committee Reports were published. Concurrently, the adequacy of all radiation protection standards as they apply to all members of the public including those occupationally exposed is under continued surveillance.

In addition, the NCRP has constituted several scientific committees to evaluate exposures of the public from different radiation sources, and to consider the question of radiation apportionment. Should new evidence emerge from these NCRP studies, the current radiation protection standards may then be appropriately revised.

Very truly yours,

Ahmed Rafi

A. Rafi
Senior Engineer

AR:jcm

I-12

P. O. BOX 013100, MIAMI, FLORIDA 33101
FPL
FLORIDA POWER & LIGHT COMPANY

July 25, 1975
L-75-375

Director, Criteria and Standard Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Florida Power & Light Company wishes to respond to the May 29, 1975 Federal Register notice (Volume 40 number 104, Part II) by supporting the comments submitted by the Atomic Industrial Forum. FPL has membership on the Forum;s ad Hoc Working Group on Radiation Criteria and ALAP and wishes to reinforce the Committee's comments as submitted.

It is the feeling of the Florida Power & Light Company that the EPA should hold a rule-making hearing in regard to their proposed uranium fuel cycle radiation standards. This hearing should furthermore provide the opportunity for EPA personnel. We believe that this hearing should be deferred until such a time as further studies on the EPA standards can be conducted.

Yours truly,

Robert E. Uhrig

Robert E. Uhrig
Vice President

REU:JAD:nch

cc: Jack R. Newman, Esquire

Atomic Industrial Forum, Inc.
475 Park Avenue South
New York, New York 10016
Telephone: (212) 725-8300
Cable: Atomforum Newyork

July 25, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460

Subjects: Comments of the Atomic Industrial Forum, Inc. on Proposed EPA Standards entitled "Radiation Protection for Nuclear Power Operations"

Dear Sir:

In response to the May 29, 1975 Federal Register notice (Volume 40, number 104, Part II) the Forum's Ad Hoc Working Group on Radiation Criteria and ALAP has prepared comments on the EPA's proposed standard entitled "Radiation Criteria for Nuclear Power Operations", and the "Draft Environmental Statement" (DES) associated therewith. Though the comments contained herein were prepared by the above mentioned Ad Hoc Working Group, they were also endorsed by the Forum's Fuel Cycle Services Committee the membership of which is indicated in Attachment 1.

Due to the breadth of information that must be reviewed to prepare detailed technical comments, the Working Group members wish to emphasize that additional and more substantive comments to those contained herein would be presented at the requested rulemaking hearing (see AIF letter dated July 24, 1975).

The following individuals are members of the Ad Hoc Working Group and participated in the preparation of comments:

Eric N. Sloth, Chairman	Nebraska Public Power District
John G. Robinson, Chairman Subcommittee on EPA Standards	Yankee Atomic Electric Company
Marvin S. Fertel, Secretary	Atomic Industrial Forum, Inc.
Robert A. Adams	General Atomic Company
R.L. Ashley	Bechtel Power Corporation
R.B. Borsum	The Babcock & Wilcox Company
Robert A. Burns	Niagara Mohawk Power Corporation
George F. Caruthers	Combustion Engineering, Inc.
John Davis	Atomic Industrial Forum, Inc.
Owen Davis	Pacific Gas and Electric Company
Weldon D. Dillow	Tennessee Valley Authority
Richard W. Englehart	NUS Corporation
Joseph A. Franco	Ebasco Services, Inc.
John C. Golden	Commonwealth Edison Company
Lee Hairr	Environmental Analysts, Inc.
Wade Larson	Boston Edison Company
Lionel Lewis	Duke Power Company
James Muckerheide	Boston Edison Company
Reginald C. Rodgers	Northeast Utilities Service Co.
Kevin L. Rooney	Sargent & Lundy Engineers
George Rymer	Westinghouse Electric Corp.
Robert L. Schlegel	NUS Corporation
Noel C. Shirley	General Electric Company
James M. Smith, Jr.	General Electric Company
Harvey F. Story	Florida Power & Light Company
Walter Strodl	Consumers Power Company
Edward A. Warman	Stone & Webster Engineering Corp.

This letter presents the group's overall impressions of the proposed standards as well as specific comments pertaining to the content and philosophy of the standards.

The working group acknowledges the intent of the proposed standards and the recognition by EPA of the need for flexibility under unusual circumstances of operation. Our major concerns with the proposed standards are, the degree of over conservatism in the models used to arrive at the numerical limits and the uncertainty regarding implementation of the proposed standards. Since the standards are written for the uranium fuel cycle as a whole, it is not clear how individual components of the fuel cycle (mills, fabrication plants, reactors, reprocessing facilities, etc.) will be affected.

Implementation

The Working Group recognizes that it will be NRC's responsibility and not EPA's to implement the standards. However, we believe it is incumbent on the EPA to ensure that the standards can be implemented. In this regard we find the DES deficient in its discussion of the implementation procedures associated with the standard. The discussion pertinent to implementation is contained in Chapter VI-D of the DES and basically states that the EPA standards would be easily accommodated within existing NRC regulations (i.e. 10 CFR 50 Appendix I) or, easily reconciled by the NRC, DOT, etc. These conclusions are not substantiated within the DES. Rather, it appears that the EPA has presumed the NRC can easily implement the standards, a presumption which is, in our opinion, unsupported by the documentation available.

Furthermore, the method utilized to implement the standards could affect the environmental and economic impact analysis associated with the standards. Therefore, the DES should contain a discussion of the alternative methods of implementing the standards and their associated environmental and economic impacts. The fact that NRC must implement the standard should not relieve EPA of the responsibility for ensuring that the standard can be implemented and of evaluating the alternatives associated with that process. The inclusion in the DES of a detailed discussion of alternative implementation procedures would appear to be within the spirit and intent of NEPA as well as in accord with President Ford's request that the regulatory agencies consider the impact of new regulations on the state of the economy.

Health Effects and Dose Modeling

As presently proposed, the standards are not applicable to nuclear parks. The Working Group agrees with the intent of not imposing the numerical criteria as contained in the proposed standards to a nuclear park. However, since the planning and development of a nuclear park or simply a multi-reactor site would necessitate knowing what regulations and standards are applicable, the EPA should at this time include proposed numerical criteria applicable to such situations. In the case of multi-reactor sites, we believe the uncertainty surrounding implementation of the standards would be accentuated and that the EPA would have to reevaluate the definition for the term "site" as presently contained in the proposed standards.

We believe it is unfortunate that the EPA radiation dose-risk estimates appear to be based solely on the BEIR Report. A more recent document which differs significantly from the BEIR Report in the use of the linear extrapolation in setting dose standards is NCRP Report No. 43, "Review of the Current State of Radiation Protection Philosophy". As stated in this document:

> "In its continuing efforts to provide recommendations with respect to possible radiation hazards and radiation standards, the NCRP has taken the following actions: (a) It has directed NCRP Scientific Committee 40 on Biological Aspects of Radiation Protection Criteria to review and evaluate the data on effects of radiation on animals and man and to analyze additional evidence that has been adduced since the 1972 UNSCEAR and BEIR Committee

> Reports were published. A substantial amount of animal data has become and is becoming available, even since the publication of those reports. Special attention will be paid to factors influencing dose-effect relationships, e.g., dose, dose rate, and relative biological effectiveness (RBE). The group will attempt to determine as accurately as possible the true risk of cancer from exposure to low-LET radiations and high-LET radiations of low doses and dose rates...."

Utilization of NCRP, No. 43 would undoubtedly have led to conclusions that higher dose limitations than those presently prescribed would be compatable with both the need to protect the overall societal interest with respect to health and safety and the need for electric power.

While the BEIR Report derives values for estimated health effects per man-rems of exposure, assuming the no threshold linear theory, the DES treats the estimate of health effects as real and not as an estimate of "potential" health effects. This thought follows through the report which concludes that these new standards will prevent a cumulative 1,000 less health effects by the year 2000. Unless these potential health effects are put on a comparative basis, such as relative to the potential health effects from natural background radiation, this concept is misleading. In addition, since medical exposure currently accounts for about 90% of all man-made exposure and the nuclear industry accounts for about 1%, we believe it is misleading to the public to discuss the nuclear industry contribution without placing it in the proper perspective.

Cost-Benefit

While the industry would hope that your projection of 1,200 gigawatts in the year 2000 may be realized or at least closely approached, it would appear more appropriate for reasons of a cost-benefit or cost-effectiveness analysis to employ the latest authoritative estimates for the growth of nuclear power between now and the year 2000. A review of the recently published ERDA report ("A National Plan for Energy Research, Development and Demonstration") projected the maximum nuclear capacity on line in the year 2000 as 800 gigawatts or only 2/3 of the 1,200 gigawatts value used in the DES analysis. This overestimate in radiation releases coupled with an optimistic view of both the development and cost for control technology gives rise to a fallacious cost-benefit analysis and we believe a dose standard that is unnecessarily restrictive.

The extensive hearings conducted by the AEC in regard to Appendix I of 10 CFR 50 discussed in detail cost-benefit analyses and methodology. EPA has utilized a cost-effectiveness analysis rather than a cost-benefit methodology thus, "ignoring" the information developed at the Appendix I hearings. Since NRC will be the responsible agency for implementing the standards it is, in our opinion, necessary for the EPA and NRC to resolve the differences in cost-benefit versus cost-effectiveness methodolgies and establish a consistent approach applicable to both the development of the standards and their implementation. We trust that prior to finalizing the standards EPA will resolve these differences and than utilize a rulemaking hearing as the forum through which additional detail and conceivably more accurate information pertinent to the cost-benefit or cost-effectiveness analysis and the establishment of both dose and curie limitations can be obtained.

Curie Effluent Limitations

The curie quantity limits particularly for Kr85 requires the application of technology that is not commercially available today nor demonstrated in a large scale operation. The EPA report in assuming the availability of the technology by 1983 also dismisses as negligible any problems involved in the collection and waste management of Kr85. Since the storage of these radioactive substances have an environmental impact and associated cost, they should be a definite part of the environmental impact and cost-benefit analyses.

In section 190.12 of the proposed standard no basis for the selection of the effective dates is given, and the January 1983 date, under section 190.12 (d), seems completely arbitrary. Since the 1983 date is 8 years away, and since commercially available technology for collecting and storage of these isotopes is presently unavailable, there appears to be no significant environmental advantage to including the curie limits in the proposed regulations at this time. Furthermore, the date for imposition of the standards should be related to the most accurate projection for nuclear power growth, the latest estimate of which, as stated previously, is much lower

than that contained in the DES. Additional effort and study should be conducted to ensure that the standards implementation dates are compatible with both ensuring public health and with practicable technology.

We question the apparently arbitrary selection of 100 years for determination of the environmental dose commitment, nor do we believe that models exist today which can realistically define the behavior of the radionuclides in the environment during a 100-year period. The 100-year time period as well as the models bear further explanation prior to finalization of the proposed standards.

Relationship to Appendix I

The DES discusses reasons why new radiation standards are required--two of which are:

1. The radiation protection guide for annual dose to individuals is unnecessarily high for use by the industry.

2. Application of the concept "As Low As Practicable" must include explicit consideration of both total population exposure and the costs of effluent controls.

Consideration of both of the above items are already incorporated in the "as low as practicable" Appendix I rulemaking proceedings conducted by the AEC (now NRC) during the period 1971 through 1975. Through active industry participation in this proceeding, substantial changes have been incorporated by NRC into Appendix I which became effective June 4, 1975.

The final version of Appendix I differs significantly from the proposed version of Appendix I. As stated in the statement of consideration for 40 CFR 190, "...the agency has carefully examined the guidance for design objectives and limiting conditions for operation of light-water-cooled nuclear power reactors as set forth recently by the NRC in Appendix I to 10 CFR 50. It is the view of the agency that this guidance for reactors will provide an appropriate and satisfactory implementation for these proposed environmental radiation standards..." From the Working Groups review of the content of the DES, it is our belief that the proposed EPA standards are based upon the proposed and not the final version of Appendix I. We, therefore, recommend that the EPA reconsider their standards based upon the extensive analyses and hearings resulting in the final version of Appendix I.

As presently proposed the EPA standard could be more limiting to current siting practices than Appendix I. Appendix I dose limits are 3 millirem per year per reactor for liquid releases and 5 millirem per year per reactor for gaseous releases. It is possible that the implementation of the dose limits could be construed as a limitation of 8 millirem per reactor per site which, combined with the EPA dose standard of 25 millirem per year per site (including direct radiation) could limit the number of reactors at a site below current siting trends. We believe the current trend towards multiple reactor sites is both cost-effective and compatible with satisfying the nations environmental and energy goals.

In view of the foregoing, it would seem logical and appropriate for EPA to recognize the results obtained from the extensive proceedings at the Appendix I hearing and to accept its final version by incorporating in Part 190, a statement that compliance with Appendix I to 10 CFR 50 (effective June 4, 1975) provides satisfactory implementation of the Part 190 regulation.

The Forum and Working Group have submitted these comments with intent to be constructive. We welcome any opportunity to pursue this matter further with EPA or to clarify any statement contained herein.

Sincerely,

Howard J. Larson

Howard J. Larson
Vice President

HJL/jri
Attachment

Attachment 1

Nuclear Fuel Cycle Services Committee

R.W. Deuster, Chariman	Nuclear Fuel Services, Inc.
E. Gordon, Secretary	Atomic Industrial Forum, Inc.
A.E. Aikens, Jr.	Dames & Moore
E.R. Astley	Exxon Nuclear Company
R.B. Atwater	Consumers Power Company
W.W. Brandfon	Sargent & Lundy
J. Cagnetta	Northeast Utilities Service Co.
A.B. Carson	General Electric Company
R. Chastain	Southern Services, Inc.
W.P. Chernock	Combustion Engineering, Inc.
B.H. Cherry	GPU Service Corporation
J. Coughlin	Public Service Indiana
P. Courcier	Pechiney Ugine Kuhlmann
J.K. Davidson	Nuclear Associates International
R.E. Kettner	Nuclear Assurance Corporation
F.W. Kramer	Westinghouse Electric Corporation
P.M. Krishna	Public Service Electric & Gas Company
C.R. Johnson	The Babcock & Wilcox Company
T.A. Flynn	Stone & Webster Engineering Corporation
R.C. Murphy	Houston Lighting & Power Company
H.C. Ott	Ebasco Services, Inc.
G.B. Parks	Kerr-McGee Corporation
R.W. Peterson	Allied-General Nuclear Services
W.J. Price	Allied-General Nuclear Services
G. Rifakes	Commonwealth Edison Company
J.K. Pickard	Pickard, Lowe & Associates
G.E. Shay	Pennsylvania Power & Light Company
H.B. Stewart	General Atomic Company
L. Sonz	Public Service Electric & Gas Company
R.J. Tallman	Bonneville Power Administration
K.D. Vrooman	Niagara Mohawk Power Corporation
W. Witzig	Pennsylvania State University
B. Wolfe	General Electric Company

New Members

K. Cohen	General Electric Company
L.L. Grumme	Washington Public Power Supply System
R.F. Mantey	Philadelphia Electric Company

I-14

Washington Public Power Supply System
A JOINT OPERATING AGENCY

P. O. Box 968 3000 Geo. Washington Way Richland, Washington 99352 Phone (509) 946-9681

July 25, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
EPA
Washington DC 20460

Subject: PROPOSED RULEMAKING: 40CFR190 "ENVIRONMENTAL RADIATION PROTECTION FOR NUCLEAR POWER OPERATIONS"

Reference: 1) EPA 520/9-73-003 Parts I, II and III

Dear Sir:

The Washington Public Power Supply System appreciates the opportunity to comment on the proposed rulemaking.

One area of concern is the 25 mrem annual dose equivalent to the maximum individual in the population, as well as the 25 mrem organ dose except for the thyroid. An examination of reference one gave no technical basis for such a limit for either whole body or organ exposure, nor does it give an adequate cost-benefit analysis of such a dose limit decision. An unfortunate effect of this dose limit might possibly be to abort the energy-park concept before its feasibility and social benefits can be established. As you know, the NRC was directed by Congress to review this concept and its impacts. It would appear ill-timed to promulgate rules that would preclude our nation this option before it has been fully explored.

While reduction of exposure to the public is a laudable goal, unjustified reduction past prudent limits cost our society many options without a commensurate return in social benefits. The 10CFR50 Appendix I rulemaking used a $1000 per person-rem as a reasonable dollar expenditure for reduction of population exposure. It would appear that such an approach would have been a useful analytical tool in reference one, especially in Volume III, and would have afforded you a better technical base to establish the proposed limits.

It is unclear as to why the individual organ dose was set at the same level as the whole-body dose. This action runs counter to the recommendations of the ICRP and NCRP. It is well known that the individual organs can generally tolerate a larger insult than the total organism, no matter what the source of the elevated stress. This is particularly true of the thyroid and the skin. With proposed 40CFR190 already acknowleding this fact with the higher thyroid dose limit, it is suggested that a factor of six times the whole-body dose be used for the thyroid and skin and three times for all other individual organs. This would bring the proposed regulations into agreement with present state of our knowledge, the established standards and practices.

We will be glad to discuss these matters in greater detail with your staff to further this rulemaking.

Sincerely yours,

N O Strand

N. O. STRAND, Assistant Director
Generation and Technology

NOS:WLN:ho

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, 175 CURTNER AVENUE, SAN JOSE, CALIFORNIA 95125
Mail Code 683
Phone (408) 297-3000, TWX NO. 910-338-0116

NUCLEAR ENERGY
DIVISION

BWR PROJECTS DEPARTMENT

July 25, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
United States Environmental Protection Agency
Washington, D.C. 20460

Dear Sir:

SUBJECT: ENVIRONMENTAL PROTECTION AGENCY, PROPOSED RULEMAKING, 40 CFR PART 190, ENVIRONMENTAL RADIATION PROTECTION FOR NUCLEAR POWER OPERATIONS

In accordance with the notice in the Federal Register, Volume 40, Number 104, Thursday, May 29, 1975 at 23,420-25, the Nuclear Energy Division of the General Electric Company hereby transmits our recommendations with regard to the associated public hearing on the subject proposed rulemaking, and our initial comments on the proposed standard and its associated guidance and Draft Environment Statement. Our comments represent a general outline of the testimony we plan to develop for presentation at the public hearing.

Our indication of desire to participate in the public hearing on the proposed rulemaking was transmitted in our previous letter dated July 22, 1975.

Sincerely,

Ivan F. Stuart

Ivan F. Stuart, Manager
Safety and Licensing

:jh

Attachment

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, 175 CURTNER AVENUE, SAN JOSE, CALIFORNIA 95125
Mail Code
Phone (408) 297-3000, TWX NO. 910-338-0116

NUCLEAR ENERGY
DIVISION

July 25, 1975

Recommendations and Comments by the Nuclear Energy Division General Electric Company on Environmental Protection Agency Proposed Rulemaking 40CFR Part 190 Environmental Radiation Protection for Nuclear Power Operations

A. Summary Comments

Our review considers the proposed regulation 40CFR190 and its associated guidance, draft environmental statement and other EPA documentation released May 23, 1975.

The general intent of the proposed regulation to minimize public health impact due to radiation of nuclear power facilities is a stated policy of the Company. Our interest in the development of reasonable and proper regulations toward this objective is indicated by our full participation in the Appendix K (ECCS) and Appendix I (ALAP) hearing processes. We plan to participate in the regulatory development process on the subject EPA proposal to the fullest extent possible.

Our experience in the above referenced and other hearings indicates to us that full technical interchange is essential in the development of such regulations to provide better assurance that the result is reasonable, proper, and practicable. Therefore, we have included in our comments below recommendations to achieve this goal.

An important aspect of the proposed regulation is that it will be promulgated by the EPA and implemented in the licensing process for facilities by the NRC. Our experience indicates that the methods of implementation are of equal importance to the regulation itself. Therefore, it is essential that the review and hearing process permit adequate presentation and review of implementation and enforcement methods to be used. There has been an historic tendency in the nuclear industry to use calculational techniques which conservatively estimate future potential impact due to radiation. This tendency developed to assure a high probability of conformance to permissible doses. Now that regulations are developing specifying control to a few percent of historic permissible levels, and where actual doses may be not too far below the tighter controls, it is important that implementation be on a "best-estimate" basis. Any Environmental Statement evaluation should indicate expected impacts; we find that the subject DES continues many of the conservative assumptions and analytical methods that have been prevalent. Any overestimate of dose has a directly misleading effect on cost-benefit analysis which is one of the fundamentals of the EPA standards development process.

For purposes of establishing radiation protection standards, the responsible technical bodies for some years have used the assumption that there is a linear relationship between radiation dose and health effect. As most of the data on human effects from radiation have been from high doses and/or dose rates, the UN committee, the NCRP, and the NAS-BEIR Committee have cautioned against the use of risk coefficients at doses and dose rates orders of magnitude lower than the data base. Thus, in the evaluation of dose levels, such as those of the proposed regulation, there is a real probability that the use of such risk coefficients at low dose rates can further distort cost-benefit conclusions.

It is true that the current Federal Radiation Protection Guide (500 mrem per year to individuals in the public) is "unnecessarily high" (BEIR Report) with regard to operation of nuclear power cycle facilities. This has arisen from the fact that commercial nuclear facility design and operation always has had the objective of maintaining doses well below such a level. The FRPG never has been used as a design basis. With regard to reactors, the recently promulgated Appendix I insures that doses from effluents will stay at the desired low level. The increased scope of the proposed regulation to include direct radiation from facilities requires careful evaluation to insure that the cost-benefit fundamental of EPA standards development is achieved.

There is no timewise urgency in applying the proposed dose limits. The EPA documentation states that for reactors, conformance to Appendix I will provide conformance to the proposed regulation. We are concerned that this conclusion was reached on the basis of the 1974 proposed Appendix I and needs review on the basis of Appendix I as promulgated on April 30, 1975.

With regard to the proposed curie emission limits for certain long-lived radioisotopes, the impact would arise principally from facilities later in the fuel cycle. Thus, the operating experience data base is not yet available to determine the practicability and cost-benefit aspects of application. The assumptions used for source terms and environmental behavior of these materials may be conservative, and thus the probable impact may be considerably less than evaluated in the DES. A significant implementation problem is foreseen with regard to apportionment of emission limits to various segments of the cycle, and relation to a power plant year. Since there is even less time urgency for institution of such emission limits, it is recommended that they be deferred for study and development.

Our comments are expanded in the sections which follow which include:

B) Estimation of Risk
C) Relation to Appendix I
D) Implementation
E) Cost-Benefit Evaluation
F) Reactor Impact and Evaluation
G) Impact on Fuel Reprocessing
H) Impact on Fuel Manufacturing
I) Technical Comments on Proposed Part 190
J) Recommendations for Public Hearing

B. Estimation of Risk

The guidance for the proposed standard (at pages 4 and 5) refers to the use of the linear dose-effect assumption as a basis for standards, and that the range of estimates of health risks derived from existing data is broad. However, all the estimates in the DES of potential health risks are based on the linear assumption. Risk coefficients based on the linear assumption are valid only for the data base of high dose and/or dose rate, and thus are unduly conservative for the doses and dose rates considered here and are not appropriate.

The status of radiation protection philosophy is succinctly summarized in the statement of February 10, 1975 by the Board of Directors of NCRP, accompanying the announcement of publication of NCRP Report No. 43. The Report concludes that no changes are required in the NCRP 1971 conclusions. NCRP has studied both the BEIR Report (referenced by the EPA in this proposal) and the 1972 UN Committee Report. Available human data are mostly from high dose rate experience. The use of the linear assumption for standards establishment according to NCRP "does not imply acceptance of this hypothesis as either proven or highly probable. Numerical estimates of risk based on this conservative assumption could prove eventually to be very unrealistic."

Also the NCRP indicated that a dose delivered over a long period of time at low dose rate not only diminishes the frequency of an effect but the latent period may be so long that the effect will not occur within the human lifetime.

On calculating risk coefficients, the NCRP says:

> "The linear hypothesis, by its very nature, makes it possible to calculate risk coefficients, i.e., the number of cancers or other effects that would be expected to occur in an exposed population, of a given size, per unit of radiation dose. It must be emphasized, as noted earlier, that risk coefficients derived from the linear hypothesis are based on data obtained at high doses and high dose rates. The National Academy of Sciences (BEIR Committee), in its 1972 report, cautioned against the use of risk coefficients at doses and dose rates orders of magnitude lower than those at which observations were made. The United Nations Committee, in its 1972 report, expressed a strong opinion that the uncertainties in the linear hypothesis are such as to make it inadvisable to use risk coefficients except in regions where data exist. The evidence for both dose rate effect and departure from linearity are such that the NCRP believes that the concern expressed by each of the committees is warranted."

The EPA documentation, while containing some limited qualification, bases its estimates of potential health effects on direct use of the linear assumption. Cost-benefit are on the same basis. The EPA news release of May 23, 1975 on this subject says:

> "Train estimated that the potential health effects impact of the proposed standards limiting releases of these materials over the next 25 years would be a reduction of more than 1000 cases of cancer and serious genetic effects."

Public understanding of problems on risk is illustrated by the Wall Street Journal translation of this as:

> "The stricter standards would prevent 1000 cases of cancer or serious genetic damage during the enxt 25 years, Mr. Train said."

At several places in the EPA documentation, a potential effect at the beginning of a long sentence becomes an effect (unqualified) at the end of the sentence.

The EPA-DES at page 82 is quite misleading on the potential health effects from short-lived materials from reactors. Although the Federal Radiation Guides refer to permissible dose levels, all commercial reactors have been designed and operated to limit neighbor dose to a few percent of permissible dose. Consequently, the implication that Appendix I will prevent 34,000 potential health effects is misleading.

It is noted that the reduction of the 1000 potential health effects is directly associated with the controllable long-lived materials, Kr-85, I-129, and Pu-239. Detailed review is needed as to the extent these potential effects are based on calculations which include overly conservative assumptions as to the subsequent behavior of these materials in the biosphere. A point of perspective would be provided if the potential health effects of the hundreds of thousands of curies of plutonium already in the biosphere from weapons, testing and other non-commercial sources, were similarly evaluated.

If the potential impact of H-3 and C-14 are to be included at all in this documentation, these materials not being included specifically in the proposed standard, it is suggested that they be put in perspective by comparison with natural inventories of these isotopes as well as tritium from weapons testing.

It is recommended that the documentation indicate that potential health effects calculated from the linear hypothesis may range from zero to the numbers quoted, and that cost-benefits be estimated similarly.

It is suggested that the EPA should significantly qualify all the potential risk and cost-benefit conclusions based on the above considerations, to aid in proper public understanding of nuclear power impact and in evaluation of the proposed regulation.

C. Relation to Appendix I

The first GE meeting with the AEC Commissioners and Staff on "as low as practicable" for reactor effluents occurred in March 1970. The technical interchange and learning process had many facets starting with meetings with the Staff in January 1971, an initial proposal, two stages of hearings with extensive testimony, a DES with comments thereon, an FES which was a substantial revision of what had gone before, closing statements, a second proposal, reply statements, and finally oral argument in June 1974. The promulgated Appendix I of April 30, 1975 built on this entire record was quite different than the thoughts of 1970 and the proposal of 1971. Even today the development process continues as the proposed methods of implementation are yet to be issued.

In any such regulation, the methods of implementation are of equal importance with the regulation itself, and this is recognized in Appendix I. A major question on the current EPA proposal is how it will be implemented. Based on the learning experience on Appendix I, it appears essential that development of the EPA proposal consider how it will be implemented. Conservatisms in implementation can make any reasonable objective unreasonable to achieve or to demonstrate compliance.

Even as applied to water reactors, the EPA proposal is quite different than Appendix I. One specifies limits with undefined variance; the other specifies objectives and defined flexibility factors. One is applied in effect as a site (or combined nearby sites) limit; the other is clearly per reactor plant. One includes direct radiation (shine) from the facility; the other is clearly limited to effluents. In the EPA proposal, with the exclusion of the skin and eye as organs, it is not evident how external beta radiation is to be handled, and what will be the limiting organs.

The EPA documentation indicates that for water reactors, conformance to Appendix I as promulgated will also be conformance to the EPA proposal. For reasons of the above stated basic differences, there is concern that this may not prove to be so. It is feared that downward racheting of Appendix I might result. This would be a serious consequence considering the extensive development and effort that went into Appendix I which concluded that the dose objectives and associated requirements did achieve a proper balance of ALAP objectives, including public health. This concern is augmented by noting that in a number of places the EPA-DES and Statement refers to proposed Appendix I (of February 1974) rather than Appendix I as promulgated on April 30, 1975.

For other portions of the fuel cycle, and for the moment assuming that the EPA proposal has the same as low as reasonably achievable (ALARA, the successor to ALAP) objectives, the EPA proposal has the effect of imposing ALARA without the operating experience base, the technical interchange, and development process necessary to determine whether the proposal is indeed practicable and would achieve the public health benefits claimed.

D. Implementation

The implementation of and indication of conformance to any radiation standard where the dose objective or limit is at a level not too far above expected operational results is crucially dependent on the use of best-estimate rather than arbitrarily conservative methods of dose evaluation. This is quite different than indication of conformance to the long-established permissible dose limits for the general public. As facilities have been designed to limit off-plant dose to a small portion of permissible dose, this permits the luxury of conservative and sometimes unrealistic assumptions with the result of still showing conformance with a margin of one to two orders of magnitude.

The need to use best-estimate dose estimation methods was clearly indicated in the ALAP hearing record, and was recognized in Appendix I. The oft quoted statement of ALAP Hearing Board Member, Dr. Walter H. Jordan, aptly summarized the problem:

> "(I)nterpretation of Appendix I is almost going to be as important a factor in what is practicable as the regulation itself."
> (RM-50-2, Tr. 2547-48)

Page 3 of the EPA statement of considerations for the proposed regulation makes it clear that the responsibility for implementation and enforcement of both the guidance and the proposed standards is now vested in the NRC. Therefore, it is essential that the NRC participate in this comment and hearing process, and that their contribution adequately defines their intended implementation methods. The optimum procedural approach needs to be worked out so that the guidance, regulation, and implementation aspects can be considered as a package. The ALAP hearing showed that this was necessary. It is equally true for the current proposal.

We believe that the NRC Opinion on Appendix I said that the prior implementation methods of the Staff were on the conservative side of "best-estimate". The Staff is currently revising the associated draft regulatory guides to implement the Opinion. On the important radioiodine-milk pathway the current EPA-DES at pages 62-63 properly indicates the conservatisms that merit correction. Similar attention needs to be given to each facet of the proposed EPA regulation at each application phase of the fuel cycle for each of the radioactive effluent pathways.

The proposed regulation includes a new area of concern, direct radiation (shine) from a facility which needs particular attention. Since direct radiation was not a consideration in Appendix I, the current proposal is the first which will consider this at the ALARA level. Thus, it is important that the hearing record establish that the proposed regulation can encompass this additional facet with full regard to cost-benefit. Neighbor location and occupancy factor assumptions to be used in implementation are of great importance due to the very rapid attenuation with distance of direct radiation.

Implementation to be used for the curie emission limits for long-lived isotopes will be of importance primarily at fuel reprocessing facilities and fuel manufacturing facilities using recycled uranium fuel. Due to the lack of sufficient operational experience base, such implementation is currently largely uncharted territory. Thus, implementation methods developed now must await operating experience to indicate their feasibility.

For any facility, an important aspect of implementation is the assumption made with regard to potential future occupancy locations by humans.

To the extent that implementation and enforcement are based on off-plant monitoring, particular care will be needed to determine the dose contribution to any person from radioisotopes released from facilities not a part of the fuel cycle. This may be especially true of radioisotopes discharged to the nation's waterways, if the story is true that hospitals discharge more curies than do nuclear facility liquid discharges. Perhaps an extreme example of this is indicated in the Palo Verde DES of April 1975 where it is stated that about half of the radioiodine-131 emission to the atmosphere from the plant will be due to iodine intake in plant makeup cooling water of Phoenix sewage origin.

The subject of backfitting of existing facilities is not specifically considered in the proposed regulation or guidance. The intent of the EPA and the views of the NRC are needed before interested parties can comment.

E. Cost-Benefit Evaluation

We have not as yet made the required in-depth study of the cost-benefit calculation methods and assumptions used in reaching the conclusions reached in the EPA documentation.

Values for various types of man-rem due to radiation dose are necessary. It is noted that the NRC Appendix I Opinion designated an interim value of $1000 for off-plant dose reduction, emphasized that this is a conservative outer limit figure, and that the NRC proposed to initiate a further rulemaking to ascertain the worth.

It is not evident in the EPA documentation that the additional occupational man-rem dose due to the augmented treatment systems, particularly at reprocessing plants, and its cost have been factored into the cost-benefit calculations.

It is not evident that the EPA documentation includes the costs of the additional waste storage facilities required for the additional radioactive material to be retained.

Real costs of future augmented treatment systems, now only at the laboratory or pilot plant scale, are nebulous. Future real costs have a tendency to exceed current estimates.

With regard to reactors, apparently the EPA cost-benefit evaluations are based on data available in mid-1973, prior to the environmental phase of the Appendix I hearing. Reference to and use of the cost-benefit testimony of the Consolidated Utility Group would provide a more realistic estimate of the value of each augmented system considered in the AEC-ALAP-FES in 1973. At the same time, the overestimates of off-plant dose were covered in the GE testimony, closing and reply statements, and oral argument. The combination of underestimation of costs and overestimation of dose significantly impact on cost-benefit conclusions. It is noted that the EPA documentation refers to the fact that certain of the expensive augmented treatment systems suggested in 1973 by the AEC Staff, particularly charcoal filtration of large ventilation exhausts, may not be needed. We firmly believe that Appendix I with proper implementation will indicate that this is clearly so. Thus, we suggest revision of the bases and conclusory statements with regard to the costs of BWR effluent treatment.

It appears that the EPA feels that costs and benefits involved in this proposed regulation are adequately considered by a balance of costs of control and potential health effects. General Electric believes that this view is unnecessarily restrictive and ignores broader cost-benefit considerations.

F. Reactor Impact and Evaluation

Comments applicable in part to impact on reactor plants of the proposed regulation are included in previous comment sections on Appendix I, Implementation, and Cost-Benefit.

It is noted that Table 10 of the DES shows 170 potential health effects up to the year 2000 from short-lived material which is mostly from reactors, based on an evaluation using the AEC proposed Appendix I of February 1974. The DES needs to reevaluate this potential effect based on Appendix I as promulgated. The result would then be compared with the 160 potential health effects ascribed in the DES assuming the proposed regulation is implemented. The difference would then be a first indication of the impact of the proposed regulation on reactor plants.

The expected whole body doses in the model projections of the DES Table 3 apparently are "fence post" doses without regard to occupancy factors and other real mitigating effects. The summary results do not agree with the new plants of Table 5. The thyroid doses apparently assume that there is a milk cow and a baby drinking raw milk at the nearest farm. Apparently twice the expected iodine emission was evaluated. Table 3 includes no evaluation of direct radiation from the facilities.

As indicated in the DES, at pages 41 and 62-64, the expected doses from radioiodine-131 emission are probably at least an order of magnitude lower than that resulting from the calculational models used in the DES and in project Environmental Statements. Apparently the DES ignores this fact in determining doses and the cost-benefit balance.

The DES Table 5 obviously does not consider Appendix I as promulgated. The entire table is of little current informational value as it was obviously prepared some time ago. It is based on source term assumptions and calculational models of draft regulatory guides now being revised; thus, most of the doses listed, and many of the footnotes, are incorrect. The "site gamma" doses do not reflect information in the environmental statements in all cases; certainly the 500 hours at the site boundary is an improper evaluation base in many cases. Footnote references to turbine building effluent and the various required fixes are generally wrong. It is difficult to condense so much information into a simple table unless extensive footnotes are provided in many cases. The entire table should be updated or deleted. Similar comments probably apply to Tables 4 and 6 also.

In the DES Table 7 there is no virtue in showing calculated unshielded fence post doses without some attempt to estimate doses to actual persons in the vicinity. Such an estimate would show that actual dose was in the range of a few percent of permissible dose which was the general design objective for these plants when built. The "baseline" value of Figure 5 apparently refers to a design basis source term, unrelated to actual release.

One of the two basic principles for standards establishment adopted by the EPA is cost-benefit. Thus careful consideration is needed of the limit proposed for whole body dose with regard to direct radiation (shine) from nuclear facilities. This is of particular interest for radiation from Nitrogen-16 in steam cycle equipment for Boiling Water Reactors. Plants with equipment geometries of the large plants now in design and construction have only recently gone into operation. The first sensitive field measurements of direct radiation from such typical plants have been made only in recent months. Initial results show that off-plant levels at a typical site would be within the normal variation of natural background radiation dose. Studies to date indicate that further reduction of this dose contribution are very unfavorable if a balancing of cost and benefit is done.

The EPA appears to conclude that this dose contributor will not be significant based on the data from Environmental Statements for reactors as listed in the DES Table 5 where most sites are shown as less than one mrem per year. This is strongly dependent on occupancy time and location assumptions, and we note that in a number of cases, different approaches were taken in the Applicant's Environmental Report and the Commission's Environmental Statement. In some cases, the location of probable maximum actual dose may not have been considered in the Environmental Statements or was not reflected in Table 5.

For the newer larger plants in the Table, cost penalties which do not appear in the EPA evaluation have already been taken in the form of additional shielding or other costly steam cycle equipment arrangements. These steps have been taken in the absence of quantitative guidelines in the past and in anticipation of possibly restrictive future requirements. Thus to conclude that there are no costs in meeting the proposed whole body dose limit is not correct.

As cost-benefit is a fundamental in the EPA standards establishment process, it appears that sufficient information on the cost of direct radiation shielding has not been considered.

G. Impact on Fuel Reprocessing

Proper consideration of the impact of the proposed regulation on fuel recovery plants is necessary. The proposed emission limit for transuranics would require more capital investment in gaseous effluent filtration than has hereto fore found to be necessary. The AGNS recovery plant has a proposed Technical Specification limit on alpha effluents of one curie per year. It is our understanding that they have an engineered capability of holding emissions to 0.135 curies per year, but the proposed EPA standard would limit it to 0.022 curies per year. (This is based on the equivalence given in the EPA DES, Table 1, page 30 of a 1500 MTU/Yr recovery plant supporting 43 LWRs, taken to be equivalent to 43 GWe-years.) This example is based on no allowance for emission of transuranics anywhere else in the fuel cycle.

The justification presented by the EPA is highly biased to provide support for their proposed regulation. In attributing a long-term dose commitment to I-129, the report fails to take into consideration the relatively rapid disappearance of this material from its point of deposition. BNWL-1783 reports that I-129 in milk samples from cows near NFS declined from 2 to 0.01 pCi/ℓ in a one year period following cessation of operation. The EPA assumes that I-129 is available for greater than 100 years.

In presenting the potential future impact of tritium and carbon-14, the EPA report does not provide any comparison of the amounts originating from nuclear power production with that in the Earth's existing inventory. Until after the end of the century, the nuclear fuel cycle adds but a small quantity in comparison to natural inventory and that from weapons testing. Further, reference 16, cited in the DES, quantifies additional exposure at the end of the century due to C-14 from the world nuclear power industry as being 0.2 mrem per year (whole body).

The DES also overplays the buildup of Kr-85. Reference 16 quantifies the whole body exposure from Kr-85 from the world power industry as 0.04 mrem per year at the end of the century.

In equating health effects with the dose commitment from long-lived alpha emitters, it appears that the EPA has assumed that release of the alpha emitters will automatically produce exposure. The intentional grazing of cattle on Pu contaminated pasure (NVO-142) failed to produce the anticipated Pu uptake. Without any additional regulation, the projected release (EPA-DES, p. 79) of transuranics of the order of 10 curies in the next several decades should be compared with the current biosphere inventory from weapons testing which is four orders of magnitude greater.

H. Impact on Fuel Manufacturing

1. General Comments

The proposed regulation could have a significant impact on fuel manufacturing activities. The principal areas of concern are:

a. Conformance with the more restrictive annual dose limits cannot be established by direct measurement, and the method of apportioning such limits among the various fuel cycle facilities is not defined.

b. Activity releases for the steps in the uranium fuel cycle utilizing recycled uranium will be regulated by the amount of power generated by the fuel cycle. The values proposed are not based on operating experience nor is any indication given as to how such values would be generated or applied.

The proposed regulation appears to be issued without thought as to how it can be implemented, nor is it based on demonstrated technology. It therefore provides a basis for more rulemaking with built in conservative conditions to assure meeting limits. The resulting impact on business could be extensive.

2. Specific Comments

a. It is recommended that the portion of the proposed regulation that specifies a release limit for plutonium and other transuranics in terms of power generated by the fuel cycle be deferred until operating information is available.

b. There is a need to define the methodology to be utilized for determining the allowable release in a given year. This methodology should be made available for comment. Complete comments cannot be made on the proposed regulation without having the proposed methodology available.

c. There is a need for a development document for the proposed regulation. This document should include:

   i. Definition of the limit of plutonium and transuranics in reprocessed uranium used to establish the standard for each of the fuel cycle segments.

   ii. Demonstration of how plutonium and the transuranics would be expected to concentrate or be spread through each of the steps in the reprocessing, enrichment, and conversion steps.

   iii. A demonstration as to how the millicurie and exposure limits would be determined for each step of the cycle.

   iv. A demonstration as to how the millicurie and exposure limits would be applied to each step of the cycle at specific manufacturing sites.

The information in this development document should be based on operating information obtained from the fuel cycle including fuel reprocessing and fuel fabrication utilizing recycled uranium. Such items as demonstrated residual limits of plutonium and transuranics in reprocessed fuel, and how these residuals concentrate in the fuel fabrication process steps should be included.

d. The methodology should be defined which will be utilized for measuring, recording and finally determining compliance with the dose limits. This methodology should be available for comment.

I. Technical Comments on Proposed Part 190

In proposed section 190.02 (c) and (d) the definitions of "general environment" and "site" appear to be different than definitions of somewhat similar terms in the various NRC regulations. Differences should be minimized where possible. Possible problem areas may arise where portions of a site, such as roads, are established as being subject to access control during postulated accident situations, but where there is no thought of control being needed during "normal" operations. The problem of occupancy of adjacent waterways is referred to in the EPA documentation. While there are a number of references to the use of factors for time of occupancy, there is no such reference in the proposed regulation itself.

In technical definitions such as for "dose equivalent" in 190.02(i), it is recommended that a definition such as by ICRU be used or referenced. With regard to organs excluded (dermis, epidermis, cornea) in 190.02(j), see comments below on 190.10(a).

A major problem with the "gigawatt-year" in 190.02(k) is how such a unit of power produced in a certain year at a power plant is to be applied in judging conformance of the proposed curie limits at other portions of the fuel cycle where the time relation may be a number of years before or after the year of power production.

In the proposed annual dose limits of 190.10(a), it is not evident why the limits for the various organs are not numerically related in proportion to permissible doses recommended by ICRP. Since the skin is excepted, it is not clear how external beta dose is to be handled, and how practicable it may be to conform to the proposed limit for "any other organ" from such external beta dose. The method of relating "whole body" dose to its proposed limit should be defined. For example, it is not clear if the proposed thyroid limit includes contribution from external radiation and from internal dose from material in adjacent organs. As indicated above in the first paragraph, occupancy factor implementation is crucial. This is particularly true for direct radiation from the facility considering its rapid attenuation with distance. Until further definition on such concerns is available in a proposal, it is not feasible to evaluate the practicability and impact of the proposed dose limits.

The curie emission limits of 190.10(b) impact principally on those portions of the fuel cycle in which there is currently an inadequate operating experience base. It is recommended that such proposals be deferred until the operating experience is available for use in formulating meaningful limits.

The variance provisions of 190.11 need clarification with regard to "a temporary and unusual operating condition." Was it intended that Section IV of Appendix I be an example of such a provision? In that case, the period of implementation was the calendar quarter. Is this compatible with "temporary"? Part 190.11(b) may require public documentation at levels not required by Appendix I.

J. Recommendations for Public Hearing

Our recommendations are based on our experience in the past several years at several EPA and AEC legislative type hearings, and our full participation in the RM-50-1 hearing on Appendix K to 10CFR50 on ECCS and in the RM-50-2 hearing on Appendix I to 10CFR50 for reactor effluents. Because the proposed regulation obviously has a greater scope and impact than Appendix I General Electric feels that it is important that the hearing on the regulation now proposed by EPA elicit all the information of significance with regard to impact, cost, and benefits so that the regulation promulgated will be reasonable and practicable. In particular, General Electric suggests that:

1. The information requested in these comments be made available. This should be done prior to a public hearing on the proposed regulation.
2. The comments of all parties on the DES and proposed regulation be made publicly available for public review and copying.
3. The deficiencies in the DES noted in these comments are sufficiently serious as to require re-issuance of the DES. This should be done prior to a public hearing.
4. After re-issuance of the DES, a public hearing on the DES and proposed regulation should be held prior to issuance of the Final Environmental Statement (FES).
5. Any additional information which EPA makes available in response to these and other comments should be made available well ahead of any hearing, preferably as a part of a new DES. This will permit the new information to be considered in the preparation of parties participating in the hearing.

With regard to a regulation of the importance of that being proposed by the EPA, there is concern that a hearing consisting of submitted written testimony and brief "limited appearance" type summary presentations by interested parties will not permit the degree of interchange of technical information considered essential to achieve a reasonable and practicable regulation. On the other hand, we do not feel the time, expense, and complexity of a full adjudicatory hearing is necessary. Some middle ground procedure is needed.

We recommend a procedure which may in part achieve the needed interchange. The total EPA initial input for the hearing should be available by a certain date. Testimony of interested parties should then be filed 60 days thereafter to permit a reasonable review of EPA testimony, and should be circulated to all parties filing testimony. Supplemental testimony based on analysis of the interchange would then be filed 60 days thereafter. At the hearing, summary position statements would be orally presented and filed. In addition to questioning by the Hearing Board of any party, it is recommended that participating parties be permitted to address questions to the EPA to permit understanding of the remaining technical issues. Thirty days after the hearing transcript is available, the participating parties should have the opportunity to file closing statements in the record. It is clear from the initial AEC Staff proposals that without this kind of interchange, Appendix I might have been quite different in content from its actual final form.

The suggested schedule has the additional advantage that time will be available to review and analyze all the backup documentation and references used by the EPA in preparation of the recently issued DES and Statement. The comment period expiring on July 22, 1975 has not been sufficient for the required in-depth review.

KERR-McGEE NUCLEAR CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

July 26, 1975

Directorate
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Gentlemen:

Please refer to the publication in the Federal Register of Thursday, May 29, 1975, of proposed environmental regulation protection standards for the nuclear power operations, 40 CFR 190.

Kerr-McGee Corporation has been actively engaged in operations in the nuclear fuel cycle since the establishment of a Uranium mine and mill in 1953. Subsequent expansions of our interests have involved Uranium Fuel Fabrication, Plutonium Fuel Fabrication and UF$_6$ Conversion. In the operation of these facilities, a highly qualified technical staff has been assembled dealing with the various problems discovered and controls established as the industry grew to its current state of maturity. Throughout this period, we have continuously observed that in the industry, application of health and safety precautions has generally met the absolute requirements of public health. The safety record of the industry speaks for itself. Kerr-McGee has promptly and effectively reacted to each technical improvement and each additional burden evolved by the ever-expanding body of regulation. As a consequence, we have, in the company of other dedicated firms in the Nuclear industry, demonstrated the ability to control public exposure to radiological hazards to less than 1% of the regulations imposed by the authoritative agency.

In the case of the current proposal and in view of the Nuclear industry performance, it is our current position that:

Directorate
Criteria and Standards Division (AW-560)
Office of Radiation Programs
July 26, 1975

1. The proposed regulation disregards the effective efforts of industry and the Nuclear Regulatory Commission to maintain releases of radioactivity to as low as practicable.

2. Extensive reliance has placed upon "the capabilities of controls anticipated by the NRC for all sites....." without speaking to the necessity of such improved control.

3. The proposed regulation accepts as a basis the linear hypothesis without recognition of the many qualifications established when the linear hypothesis was established.

4 Established dollar estimates of the cost of these controls and the benefit of them without industry participation in the development of these costs.

5. The proposed standard is one for which compliance cannot be measured directly but approximated by extensive theoretical calculation without direct measurement of the individual dose involved since it is a very small portion of background plus other man caused sources of radiation as enumerated in ORP/CSD-72-1, "Estimates of Ionizing Radiation Doses in the United States 1960-2000."

It is the position of Kerr-McGee Nuclear Corporation that the control of nuclear industry radiation exposure to the general public has been adequately demonstrated; control of other man caused radiation exposure does not exist; background radiation exceeds the proposed standard; the linear dose relationship hypothesis is not useful in very low ranges, therefore, we believe that the establishment of the standard proposed has not been demonstrated to be in the best interest of the public or the continued vitality of the nuclear industry.

Sincerely yours,

W J Shelley

W. J. Shelley, Director
Regulation and Control
Kerr-McGee Nuclear Corporation

WJS:ml

GENERAL ATOMIC COMPANY
P.O. BOX 81608
SAN DIEGO, CALIFORNIA 92138
(714) 455-2823

In Reply
Refer To: GEN-609

July 28, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Subject: Environmental Radiation Protection
For Nuclear Power Operations

Dear Sir:

This letter presents General Atomic Company's response to the May 29, 1975 notice in the Federal Register (Vol. 40, Number 104, page 23424) requesting comments on the EPA's proposed regulation, 40 CFR 190, entitled "Environmental Radiation Protection Standards for Nuclear Power Operations." These comments are general in nature due to the wide breadth of technical information which must be considered.

General Atomic Company supports the establishment of well founded radiation standards related to normalized electrical power production and the allowed-for flexibility in operation necessary to meet both the intent of the standards and the need to supply electrical power. There are, however, major questions (discussed below) which must be answered before this proposed regulation can become realistic and enforceable. These questions are (1) implementation of the proposed standard, (2) need to address the "nuclear park" concept, (3) limits on total curie releases of various radioactive isotopes, and (4) whether there is in fact a need for reduced standards. We therefore request that the proposed rulemaking be postponed until the NRC determines the cost effective radiation levels for each type of fuel cycle activity.

A. Implementation of the Proposed Standard

The first question concerns the implementation of the proposed regulation. While the Environmental Protection Agency states, "the responsibility for the implementation and enforcement of both this guidance and these standards lies, in most cases, in agencies other than EPA as part of their normal regulatory functions,"[1] the cognizant regulatory agency could interpret the proposed regulation in a manner that does not take into account the differences among the various facilities constituting the uranium fuel cycle and in a manner contrary to the considerations under which the proposed regulation was written.

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[1] Federal Register, Vol. 40, Number 104, page 23420, dated May 29, 1975

The proposed regulation was written with the idea that nuclear power industry standards consider, "(1) the total radiation dose to populations, (2) the maximum dose to individuals, (3) the risk of health affects attributable to these doses, including the future risks arising from the release of long-lived radionuclides to the environment, and (4) the effectiveness and costs of the technology available to mitigate these risks through effluent control."[2] And yet without guidance as to how the proposed regulation is to be implemented, it is impossible to ensure that the above considerations can be met. Specifically, what may be an economically feasible control program for one component of the uranium fuel cycle (a nuclear power reactor, for example) may not be economically feasible for another component (a fuel reprocessing plant, for example). There is no provision in the proposed regulation to require that the regulaory body consider the cost effectiveness of the standards they might set when apportioning the total radiation dose and effluent curie limits stated in 40 CFR 190. Also, the question of communication between different cognizant regulatory agencies is left open. This can lead to overlapping and contradictory interpretations of the proposed regulation.

One solution to this problem would be for the NRC to conduct a cost/benefit analysis for each type of facility comprising the uranium fuel cycle. This type of study would be similar to the analyses performed to determine the standards set for normal effluent releases for light-water-cooled nuclear power plants published as Appendix I to 10 CFR 50. These studies would definitively ascertain the lowest practicable effluent release standards from each uranium fuel cycle facility. Writing specific guidelines for each facility would also alleviate the need for apportioning the total allowable doses and releases from the entire uranium fuel cycle as is presently proposed in 40 CFR 190, among the various facilities. Since the EPA acknowledges that "major portions of the industry now operate at approximately one-tenth of the level permitted by the current guides,"[3] there is little immediate incentive to force a reduction in standards without (1) ascertaining the cost effectiveness of the new standards, (2) quantification of the dollar value of the risked health effects, and (3) comparison with other radiation sources (including alternate energy sources, medical, etc.). Now that the final version of Appendix I to 10 CFR 50 is in effect, it can be used as the standard for the light-water-cooled nuclear power plant portion of the uranium fuel cycle. Upon completion of the cost/benefit studies for the other areas of the fuel cycle, the resulting standards can then be referenced in 40 CFR 190.

B. Need to Address the Nuclear Park Concept

The proposed standards for normal operations is stated in 40 CFR 190.10a to be "the annual dose equivalent shall not exceed 25 millirems to the whole body, 75 millirem to the thyroid, and 25 millirems to any other organ of any member of the public as the result of exposure to planned discharges of radioactive materials, radon, and its daughters excepted, to the general environment from uranium fuel cycle operations and radiaton from these operations." Since

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[2] ibid

[3] Draft Environmental Statement concerning 40 CFR 190, page 13

radiation doses are a strong function of distance, if no uranium fuel cycle facilities overlapped "exposure" zones, the maximum dose to any member of the public could be 25 millirems to the whole body. Appendix I to 10 CFR 50 limits the exposure to an individual due to effluents from a light-water-cooled nuclear power plant to be less than 8 millirems to the whole body from gaseous effluents and 3 millirems to the whole body from liquid effluents. Hence, one effect of a 25 millirem limit in 40 CFR 190 would be to limit the number of light-water-cooled nuclear power plants at one site to three, or, for single reactor sites, the operator could operate at levels higher than those stipulated in Appendix I to 10 CFR 50.

The NRC had a similar problem, when writing Appendix I, in deciding whether to write the standards on a per facility or a per site basis, and chose the per facility basis. By using the per facility basis, one minimizes the radiation exposure of human beings from effluents while still producing a needed benefit (electrical power) at a reasonable cost for effluent control.

While the EPA agrees that these standards will have to be re-examined for multi-reactor sites sometime in the future, utilities and companies planning reprocessing facilities need to know years in advance the acceptability of potential sites. Once the regulation is implemented, there is no assurance that it will be amended to consider the nuclear park concept and thus would be detrimental to future expansion of the nuclear industry.

C. Limits on Total Curie Releases of Various Radioactive Isotopes

The proposed regulation would also limit "The total quantity of radioactive materials entering the general environment from the entire uranium fuel cycle, per gigawatt-year of electrical energy produced by the fuel cycle to less than 50,000 curies of krypton-85, 5 millicuries of iodine-129 and 0.5 millicuries combined of plutonium-239 and other alpha-emitting transuranic radionuclides with half-lives greater than one year." The summary of the draft Environmental Statement claims that "the proposed standards would limit irreversible contamination of the local, national, and global environment due to releases of radioactive krypton-85 (half-life 10.7 years), iodine-129 (half-life 17 million years), and alpha-emitting transuranics (half-lives 18 years to 2 million years).[4] Similar wording also appears on page 9 of the draft Environmental Statement.[5] The word "irreversible" should not be used in the draft Environmental Statement (1) since isotopes do decay with the given half-lives, the contamination is not irreversible, and (2) statements such as these tend to mislead the public. Also, the proposed standards cannot limit the contamination of either the local, national, or global environments. Krypton-85 is an isotope which is transported globally, and standards set in the United States alone will not assure a limiting impact. Since the United States produces only a fraction of the krypton-85 released to the atmosphere, total environmental dose commitment of krypton-85 is not controlled by United Statems limitations. Furthermore, the technology required to meet the limits of the proposed regulation do not exist today.

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[4] Federal Register, Vol. 40, Number 104, page 23424, dated May 29, 1975

[5] Draft Environmental Statement on 40 CFR 190, page 5

The technology available to the industry to control krypton-85 and iodine-129 has been, as the EPA admits, only demonstrated in the laboratory. There is no assurance that a scale-up to commercial size units is feasible or even knowledge of what the costs will be. The EPA, in the draft Environmental Statement, uses such phrases as "should achieve" (page 42), "are anticipated" (page 42), "may permit" (page 43), etc., which recognize the lack of specific information concerning the feasibility, effectiveness, and cost of the control techniques. With all these acknowledged uncertainties, what benefit is there for setting possibly unachievable and impracticable standards that are not to be implemented until 8 years into the future (January 1, 1983 as proposed in 40 CFR 190.12(b)).

If controls are deemed necessary for krypton-85 and/or iodine-129 releases, the chosen standards and effective dates should be chosen by a cost/benefit analysis for each type of uranium fuel cycle facility. The problem of apportionment is as important in this area as it is in the individual dose area. Since (1) the technology does not yet exist to meet these (krypton and iodine) standards, (2) there is a lack of knowledge with respect to its cost/benefit, (3) setting standards in the United States will have little impact on the global environmental dose commitment, and (d) the standards are not to be implemented until January 1, 1983, there appears to be no significant advantage for including these standards in the proposed regulation. These standards should be withheld pending further studies and analyses to ensure that the standard is practicable. Also, the standard on krypton-85 should be withheld pending international agreements on its control, possibly through the International Atomic Energy Agency.

D. Is There a Need for Reduced Standards

It is not obvious that "it has become increasingly clear that the current Federal Radiation Protection Guide for limiting radiation exposure of the public is unnecessarily high." The statement used to defend this view is a quotation from "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," which is a report of the Advisory Committee on the Biological Effects of Ionizing Radiation. The quotation as stated in the draft Environmental Statement on page 13 is quoted out of context. It should read: "The present guides of 170 millirems per year grew out of an effort to balance societal needs against generic risks. It appears that these needs can be met with far lower average exposures and lower generic and somatic risks than permitted by the current radiation protection guide. To this extent, the current guide is unnecessarily high." The EPA feels "that present radiation protection guidance, as it applies to the nuclear power industry, requires expansion to satisfy the needs of the times." Reactors have operated far below the 170 millirem limit of the Federal Radiation Council. There is doubt, for lack of experience, about just how far below them the fuel cycle as a whole, reprocessors in particular, can or should hold their effluents.[6]

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[6] Draft Environmental Statement on 40 CFR 190, page 15

It appears that the EPA has decided to lower the general environmental exposure limits because the industry has demonstrated a capability to operate below the present limits which would not be established if appropriate cost/benefit studies of sufficient depth had been prepared and applied. Within the total fuel cycle there is very limited experience in reprocessing, and the effects of low-level radiation in the order of the existing guide remain quite unproven, so it follows that lowering the limits now, albeit that the industry is keeping far below them, will be an action taken in part on intuition.

It is unfortunate that the result presented in the draft Environmental Statement is based solely on the BEIR report. The values derived in the BEIR report, which assumed the no threshold linear theory, are estimates of potential health effects, and yet, are treated as real by the EPA. The EPA concludes that the standards of proposed 40 CFR 190 will prevent a cumulative 1,000 less health effects by the year 2000. If another report had been compared to the BEIR report (NCRP Report No. 42, "Review of the Current State of Radiation Protection Philosophy," for example) completely different conclusions and standards may have been arrived at.

Without (1) detailed cost/benefit analyses, (2) consideration of other valid radiological health effects reports and (3) putting the "potential" health effects on a comparative basis with the health effects of other unregulated sources of radiation, the proposed rulemaking should not be undertaken.

Very truly yours,

Douglas T. Farney
Licensing Administrator
Nuclear Materials Control Division
General Atomic Company

DTF/lm

GENERAL ATOMIC COMPANY
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In Reply
Refer To: 696-618

September 10, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Subject: EPA Proposed Rulemaking
Proposed Standards for Radiation Protection
for Nuclear Power Operations

Ref: (a) Federal Register dated 5/29/75, pp. 23420-5
(b) General Atomic letter dated 7/28/75; GEN-609

Gentlemen:

General Atomic Company submitted response (Ref. b) to the subject rulemaking (Ref. a). We wish to include additional comments for your consideration in the subject rulemaking.

The proposed rule defines a member of the public as any individual that can receive a radiation dose in the general environment. The definition of general environment is so broad that it could include areas next to highways, railroads and waterways on which radioactive materials may be transported and where people may randomly or occasionally be present.

The EPA statements reflect findings by NRC and DOT that actual exposures to employed individuals participating in the transportation of radioactive materials have been very small and that members of the public should receive significantly lesser exposures. The proposed rule would impose what we believe is an unintentional and potentially troublesome 25 mR/yr limit on all exposures including surface radiation from vehicles used in normal transportation of radioactive materials. Such imposition would require NRC, DOT, etc. to significantly modify their existing package criteria, probably beyond a point of practicability or cost effectiveness. For example, because cask weights are limited by various regulations, reduced surface radiation levels from the casks would require a decrease in radioactive material per cask and would lead to a corresponding increase in the number of shipments.

We therefore recommend that the proposed definitions and/or text of the rule be modified so as to avoid the unintended effect of requiring surface radiation levels to meet standards different from those currently required by NRC and DOT.

The above comment reinforces GAC's earlier arguments that the proposed rule should not be promulgated in its existing form.

Very truly yours,

Douglas T. Farney

Douglas T. Farney
Licensing Administrator
Nuclear Materials Control Division
General Atomic Company

DTF/lm

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A. E. Schubert
President

July 28, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Subject: Comments on Proposed EPA Environmental Radiation Protection Standards for Nuclear Power Operations Published in the Federal Register, Volume 40, No. 104, May 29, 1975 (40 FR 23420)

Gentlemen:

In response to the subject Federal Register notice, we offer the following comments. In addition, we direct your attention to our letter of June 20, 1974 to EPA on the same subject, which was in response to the Federal Register notice, Volume 39, No. 92, dated May 10, 1974, inviting comments on the proposed rule making regarding the establishment of generally applicable environmental radiation standards. Those comments continue to be valid in support of these comments on the subject notice.

As a general comment, we suggest that finalization of the proposed standards at this time may be premature, particularly as to limits on specific radionuclide emissions, until there has been more research on, and thought given the actual need for standards at the levels proposed. Though the concept of "total population dose" is an intriguing theory and may ultimately prove to have valid use in environmental standard setting, there are large uncertainties in its application as stated in the subject notice and thus the real validity of this approach remains to be demonstrated before it is widely embraced as a basis for promulgation of regulations.

In commenting on the proposed standards, we have four specified areas of basic concern which are: (a) the absence of adequate justification for, or explanation of, the bases and methodology used in arriving at the values specified; (b) the uncertainties and ambiguities in respect to application of the proposed standards, and to allocation of certain emissions; (c) the absence of indication of any Federal agency interaction between EPA, NRC, and ERDA to provide for implementation of the standards in a coordinated fashion on the schedule specified; and (d) the absence of any basis for considering the potential overall advantages of multi-plant siting on a schedule that is necessary for early decisions as to multi-plant sites.

JUSTIFICATION FOR STANDARDS AND METHODOLOGY USED

The statement of consideration accompanying the proposed standards, as well as the other supporting information provided by EPA, fails to set forth adequate need and bases for the proposed standards, descriptions of the methodology and, specification of exact references used in arriving at the EPA position. For example, the statement of consideration states: "It is recognized that sufficient data are not now available to either prove or disprove these assumptions, nor is there any reasonable prospect of demonstrating their validity at the low levels of expected exposure with any degree of certainty."

Thus the impacts, if any, are so low as to be effectively immeasurable, thereby making the bases for the proposed standards speculative at best. This is particularly so as it applies to the very low levels of radiation that result from the emission of specific radionuclides such as Kr-85, H-3 and C-14. The radiation exposures resulting from such are so low that they are completely masked by routine perturbations in natural background radiation levels and by daily acts such as plane trips, trips to the mountains, visits to buildings with high-background radiation, etc., that vary one's exposure to radiation and are done without any consideration of radiation exposure. We believe that if a federal agency is to focus such strong attention on the low radiation levels resulting from nuclear power operation, it should clearly point out the relationship of the radiation levels from nuclear power to those resulting from other sources, including natural background.

Also we consider the extrapolation of the linear theory of radiation effects and the application of the man-rem concept for world-wide populations to be inappropriate bases for standard setting when applied to the very low radiation levels from a fraction of millirem to at most a few millirem per year such as are under consideration here. This approach ignores the absence of any demonstrated radiation effect on large population groups who routinely live in areas with much higher background radiation levels. It is only by taking a very small conservatively calculated radiation exposure and multiplying it by the world-wide population that one can come up with a number large enough to even have the appearance of justifying lowering the limit on emissions or taking other actions.

The above points were addressed in a letter from AGNS to the AEC dated June 20, 1974, a copy of which was attached to the referenced letter of June 20, 1974 which we sent to EPA. In the letter to the AEC, AGNS stated:

> "Further, it is our opinion that the FRC guidance of maintaining exposures ALAP was not intended to be extrapolated to extremely low doses which are then multiplied by world-wide population numbers, the product of which is then used to assess potential health effects. Such assessments are theoretical and, to our knowledge, there is no mechanism by which the impact can be measured. Thus, it is our recommendation that world-wide man-rem estimates be used only as a basis for making relative comparisons of similar facilities."

Continued application of the world-wide man-rem concept apparently relied on to-date by EPA would result in essentially no lower limit being placed on reducing already immeasurable impacts. We believe that such use is not only inappropriate but is also contrary to the main thrust of the BEIR Report(1) which apparently was used extensively in arriving at the proposed standards. In that Report, on page 2, subparagraph b, it is stated:

> "The public must be protected from radiation, but not to the extent that the degree of protection provided results in the substitution of a worse hazard for the radiation avoided. Additionally, there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise would clearly produce greater benefit." (Emphasis added)

The proposed requirements for limiting emissions of Krypton 85 and Iodine 129 do not appear to consider the full range of costs of such activities, including increased overall population exposure through higher worker exposure, and including the costs and feasibility of the storage and disposal of the collected wastes. Because the environmental radiation levels from such isotopes are so low, it may well be that continued dispersing of the quantities presently projected will be less than the impact of collecting and storing such wastes in concentrated form at a given location for a period of several years. Further, the proposed standards imply that the proposed reduction of emissions of Kr-85 will substantially reduce the world-wide radiation exposure from that isotope. Such simply is not the case. First, it is not stated in quantitative terms what that reduction would amount to. Moreover, it is debatable as to whether the total exposure from Kr-85 would be significant until perhaps well beyond the year 2000. Also the emissions from U. S. facilities account

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(1) The Effects on Population of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ionizing Radiation, National Academy of Sciences - National Research Council, November 1972.

for only a fraction of total world-wide releases, and until such emissions are limited on a world-wide basis, reduction, or even total elimination of releases from U. S. facilities would result in only a miniscule reduction in world-wide radiation exposure from Kr-85.

The methods and the exact citations from the listed references which were used by EPA, are not specified nor described adequately in the environmental statement to enable independent verification of the evaluations. It appears that EPA, in conformance with its own standards which it applies to the environmental statements of others, should expand the present accompanying environmental statement to describe clearly the methods which were used, as well as the underlying assumptions, including the cost bases, so that independent assessment can be made as to the justification for the changes.

Finally, while it appears that the EPA has the authority to issue generally applicable environmental standards, there are serious questions as to whether or not EPA's authority extends to the specification of emission limits on specific radionuclides, even though such emission limits are spread over as broad an area as the uranium fuel cycle. This appears to have the potential effect of attempting to specify directly the emission limits for individual facilities. EPA should specify generally acceptable levels of environmental radiation from nuclear facilities, and then leave it to the regulatory agency having direct authority over such facilities to determine how, or if, to prorate such total limits among the various radionuclides of interest.

APPLICATION OF PROPOSED STANDARDS

The impact of the whole-body, thyroid, and organ doses to the individual which are specified cannot be determined accurately until more guidance is provided as to the intended application of the proposed standards. The potential impacts range from no curtailment or shutdown if the standards are site standards to potentially severe impact if the standards are to be prorated over the entire fuel cycle. For example, it is not certain whether the permissible exposure is based on a single uranium fuel cycle site or on exposure to an individual at a given location from all such sites affecting him. It appears that the EPA intent is to use individual exposure as controlling, which could require all facilities affecting that individual be allocated some prorata share of the specified environmental standards. However, if such is the intent of EPA, it should be clarified in the proposed standards, and any related guidelines for application of the standards should be clearly set forth.

In regard to transportation, it is impractical to attempt to allocate a prorata share for this element of the fuel cycle. Even if so allocated, the determination of the dose received and the administration of controls would be effectively impossible because of the essentially uncontrolled environmental conditions to which shipments are subjected. However, dose rates are low enough that individual and population exposures during the course of transportation are very low unless an individual intentionally exposes himself (or herself) to a greater amount of radiation than would be received in the normal course of transportation. Therefore, it is recommended that transportation be excluded from consideration in environmental standard setting.

FEDERAL AGENCY COORDINATION

Neither the subject notice nor the supporting information indicates that the other programs necessary for implementation of the proposed standards on the schedule set forth by EPA have been, or are being, planned and implemented. Such lack of coordination in the working relationships between the Federal Agencies involved must be corrected by the lead Agency, as industry cannot assume the role of forcing one agency to act so that industry can comply with the requirements of another agency on the schedules specified. Therefore, EPA, NRC, and ERDA should present a joint schedule showing that all the necessary programs are in progress, or are planned on a coordinated basis which will permit each agency to fulfill its responsibilities on the schedule required.

PROVISION FOR MULTI-FACILITY SITING

It appears that the environmental radiation protection standards are based primarily on controlling individual radiation exposure with only a single value given for the upper limit. Strict adherence to such a single value based on individual exposure will discourage attempts at locating several facilities at a single site. This is because a few individuals adjacent to such a multi-plant site could receive a radiation exposure slightly higher than that permitted by the proposed standards even though the overall population exposure impact of such multi-plant sites may be significantly less than if the facilities were all located at single-plant sites which comply fully with the individual exposure limits. Further, the policies affecting multi-facility siting must be addressed now because persons evaluating such siting must have guidance today if such sites are to be in operation in the period 1985 to 1990. At least ten to fifteen years lead time is required from the time the decision is made to allow such siting until the facilities are in operation.

In summary, we must question whether the environmental radiation protection standards proposed in the subject notice are not premature at this time. This is particularly so as the standards relate to specific emissions such as Kr-85 and I-129. We believe that a definite schedule for reduction in emissions should not be specified at this time, and that the approach to be followed for H-3 and C-14 be followed especially for Kr-85 and I-129 pending further investigation and research into the validity of the "total population dose" concept to determine the need for such reductions. Accordingly, we request that the proposed standards not be published as a regulation or that if so published, the schedule for implementation of Kr-85 and I-129 recovery be eliminated from the standards.

We appreciate the opportunity to present these comments for your consideration, and we would be pleased to provide further clarification or elaboration of any of the points raised if this would be helpful to EPA. In addition, we request that we be kept informed of further actions which are taken by EPA, or proposed to be taken, so that we can evaluate the most appropriate avenue for our continued participation in this important proceeding.

Sincerely yours,

A E Schubert

A. E. Schubert

AES:jt

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YANKEE ATOMIC ELECTRIC COMPANY

20 Turnpike Road Westborough, Massachusetts 01581

July 28, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
U. S. Environmental Protection Agency
Washington, D.C. 20460

Subject. Comments of the Yankee Atomic Electric Company on Proposed EPA Standards entitled "Radiation Protection for Nuclear Power Operations"

Gentlemen:

In response to the May 29, 1975 Federal Register noticé (Volume 40, number 104 Part 11) the Yankee Atomic Electric Company herein submits its comments on the EPA's proposed standards entitled "Radiation Criteria for Nuclear Power Operations" and the "Draft Environmental Statement" associated therewith.

Implementation

Our outstanding concern with the proposed standard centers on the high degree of uncertainity regarding its implementation. Since the standards are applicable to the uranium fuel cycle as a whole, it is not clear how the individual components of the fuel cycle will be affected. Because of ambiguities in apportionment of radiation dose and radioactive material rel [illegible]es throughout the fuel cycle, it is difficult for us to access the impact of these standards on our facility.

The EPA should make clear its intent in setting the annual dose limits contained in Section 190.10 of the proposed regulation. Are these limits to be specifically applied to an individual facility or in cases where several facilities may be located within a geographical region are the proposed annual doses to be allocated between facilities according to some pro rata share? The structuring of Part 190 into a workable regulation requires precise definition relative to where and how the dose limitation to the general public must be applied. Lack of specificity in this regard poses the potential for legal entanglements at the public hearing stage of the licensing process. We, therefore, suggest that the regulations incorporate appropriate wording that will clarify this ambiguity.

We believe the Draft Environmental Statement must present a detailed discussion of alternative implementation procedures together with an assessment of the environmental and economic impacts associated with each alternative. In this respect, the Draft Environmental Statement is deficient and perhaps exposes EPA to challenge under NEPA. We recognize that it will be the responsibility of NRC to implement the standard, however, it is our opinion that EPA, as originator of this regulation, is under the obligation to ensure that the standard can be reasonably implemented.

Basis For Standards

EPA has relied heavily upon the BEIR Report as justification for setting the numerical limits expressed in the standards. The Draft Environmental Statement contains many selective quotes from the BEIR Report. We wish to call attention to the admonition on Page 2 of the BEIR Report, subparagraph b, which states:

> The public must be protected from radiation, but not to the extent that the degree of protection provided results in the substitution of a worse hazard for the radiation avoided. Additionally, there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise would clearly produce greater benefit.

This concern is supported in the more recent document prepared by the National Council on Radiation Protection and Measurements entitled "NCRP Report No. 43 - Review of the Current State of Radiation Protection Philosophy". The current position of the NCRP as stated on Page 4 of this document is:

> The NCRP wishes to caution governmental policy-making agencies of the unreasonableness of interpreting or assuming "upper limit" estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption. The NRCP has always endeavored to insure public awareness of the hazards of ionizing radiation, but it has been equally determined to insure that such hazards are not greatly overestimated. Undue concern, as well as carelessness with regard to radiation hazards, it considered detrimental to the public interest.

The foregoing would suggest that reasonably achievable limits, set somewhat higher than those presently proposed would not be inconsistent with essential societal interests with respect to health and safety and the need for electric power.

Multi-plant Siting

Imposition of the numerical dose criteria contained in Section 190.10 of the regulation will clearly frustrate industry efforts toward developing multiple reactor sites. EPA apparently fails to recognize that the environmental impact of multi-unit siting may result in less of an overall environmental impact than that presently incurred through dispersed siting. Inasmuch as multi-unit siting offers a distinct economic advantage and perhaps environmental advantages as well, it is encumbent upon EPA to reassess its position in this regard.

There is an immediate need, to resolve now, the criteria and standards that will be applied to multi-unit sites. Planning for future nuclear facilities is a long term process. Industry must have guidance today for planning nuclear facilities that will be required for operation in the late 1980's. It is not, as EPA suggests, premature and unnecessary to address the issue of multi-unit siting at this time.

Appendix I

For the past several years, the nuclear industry has been an active participant in the "as low as practicable" Appendix I rulemaking proceedings. As a result of this effort, substantial changes have been incorporated by NRC into the final version of Appendix I which became effective June 4, 1975. It is generally conceded by industry that Appendix I is now a workable regulation.

The standards which EPA now proposes can represent a major setback in the nuclear licensing process. To mitigate this adverse impact, we believe it is essential that EPA fully recognize results obtained from the extensive Appendix I rulemaking and officially accept is final version by incorporating in Part 190, a statement that compliance with Appendix I to 10 CFR 50 (effective June 4, 1975) provides satisfactory implementation of the Part 190 regulation.

Rulemaking Hearing

We believe the proposed standards, "Radiation Protection for Nuclear Power Operations", will result in a substantial impact on the uranium fuel cycle. We, therefore, respectfully request in accordance with the notice published in the Federal Register on Thursday, May 29, 1975 that a public rulemaking hearing be held to fully explore the basis and impact of this proposed regulation.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

Donald E. Vandenburgh

Donald E. Vandenburgh
Vice President

JRG/peb

DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

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373-4083

July 28, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Subject: 40 CFR Part 190
Environmental Radiation Protection for Nuclear Power Operations
Comments on Proposed Rules

Dear Sir:

Pursuant to FR Doc 75-14017, Duke Power Company hereby submits comments on the Environmental Protection Agency's (EPA) proposed Part 190, "Environmental Radiation Protection for Nuclear Power Operations," to 40 CFR.

While Duke is in agreement with the philosophy of the proposed rules, our basic concern is that the manner in which the limits on individual doses to members of the public are expressed results in these limits being difficult to interpret. The impact of compliance with proposed 40 CFR Part 190 will be dependent upon the apportionment of the dose criteria to the various segments of the fuel cycle. Cost benefit analysis of the proposed rules cannot be performed without knowledge of the criteria to be applied to each segment of the fuel cycle. Likewise, until such an apportionment of the criteria is performed, implementation of the proposed rules will be extremely difficult and impractical. Therefore, it is suggested that proposed 40 CFR Part 190 be revised to specifically address the limits to be applied to each of the various affected segments of the nuclear fuel cycle.

With regard to the limits specified, we note that the proposed rules are not consistent with the provisions of Appendix I to 10 CFR Part 50 as recently adopted by the Nuclear Regulatory Commission (NRC). The 10 CFR Part 50 Appendix I criteria were established by the NRC after extensive and lengthy studies and rule making hearings and are well founded and environmentally acceptable. Therefore, it would appear that the EPA should give due consideration to the content of Appendix I, and the factors which led to the NRC's adoption thereof, in the establishment of 10 CFR Part 190. Of particular concern are the difficulties which

could arise at multi-unit nuclear power reactor sites as a result of the current differences between Appendix I, as adopted, and the Agency's proposed Part 190.

It is also noted that the Agency considered the BEIR report ("The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, National Academy of Sciences, November, 1972) in the formulation of the proposed rules, but apparently did not consider The National Council on Radiation Protection's Report No. 43, "Review of the Current State of Radiation Protection Philosophy." NCRP Report No. 43 differs significantly from the BEIR Report's methodology in the use of linear extrapolation for setting dose standards. It is felt that the Agency should recognize the findings of NCRP Report No. 43, in addition to the BEIR Report, in the establishment of environmental radiation protection standards for nuclear power operations.

Based on the above, therefore, Duke Power Company recommends that the EPA not promulgate the standards as written but rather that proposed 40 CFR Part 190 be revised to:

1. Specifically address the limits to be applied to each of the various affected segments of the nuclear fuel cycle;

2. Consider the content of Appendix I to 10 CFR Part 50 and the factors which led to the adoption by the NRC of Appendix I;

3. Recognize the findings of NCRP Report No. 43 in addition to the BEIR Report.

Pursuant to FR Doc 75-14017, Duke Power Company also hereby indicates its interest in participating in a public hearing on the proposed 40 CFR Part 190 rule making. As a part of such a public hearing, we are particularly interested in being provided an opportunity to discuss the proposed rules with those personnel who developed the standards.

Very truly yours,

William O. Parker, Jr.

DCH:vr
4.4

STONE & WEBSTER ENGINEERING CORPORATION

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ENGINEERING

July 29, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Sir:

Stone & Webster Engineering Corporation wishes to respond to the invitation of the Environmental Protection Agency to comment on proposed 40 CFR 190, "Environmental Radiation Protection Standards for Nuclear Power Operations," as published in the Federal Register of May 29, 1975. Stone & Webster is vitally interested in these proposed regulations since they will undoubtedly affect the design and regulatory review of commercial nuclear power plants which we design, engineer, and construct.

Because of the nature of these proposed standards, and their potential effect upon the nuclear industry, it is believed that the EPA should hold public hearings to pursue all aspects and implications of these standards. These hearings should address as a minimum: (1) regulatory implementation of the standards, (2) interrelationship between the EPA and Nuclear Regulatory Commission (NRC) in applying radiation requirements, (3) availability of effluent control technology, (4) radiation dose models, (5) effect of standards upon development of "nuclear parks" and (6) backfitting requirements. In addition, the hearing format should allow in-person questioning of EPA personnel responsible for the proposed standards by participants of the proceedings. In scheduling these hearings, the EPA should provide adequate time for the participants to prepare substantive comments.

A considerable amount of effort, time, and money has been expended by industry and the government in the "As Low As Practicable" rulemaking hearings (Docket No. RM-50-2). As a result of these hearings, the NRC has recently issued the final version of 10CFR50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to meet the Criterion "As Low As Practicable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." Upon comparing these proposed standards with Appendix I, it appears that the two documents are not mutually consistent. This is

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particularly true when considering multiple reactor sites. There are a number of potentially serious shortcomings in the proposed standards concerning "nuclear parks" and multiple unit sites.

Since the standards are proposed for the entire uranium fuel cycle, it is not clear how the NRC will be able to apply the standards to individual components of the fuel cycle. Because of this uncertainty in apportionment of doses and release limits, it is difficult to assess how these standards will apply to individual facilities (which, of course, must be designed and licensed, individually).

The introduction to the proposed standard states: "The Agency recognizes that implementation of the standards for Krypton-85 and Iodine-129 by the proposed effective date of January 1, 1983, will require successful demonstration of control technology for commercial use that is now in the advanced stages of development.....If substantial difficulty should develop for implementing the standards for Krypton-85 and Iodine-129 with respect to the proposed levels, facility safety, or cost, the Agency will give these factors careful and appropriate consideration prior to the effective date." Stone & Webster recommends that the EPA follow the development of control technology and apply the standard only when the technology has been proven instead of "before the fact." This would mean deletion of Krypton-85 and Iodine-129 from Paragraph 190.10 (b) and deletion of Paragraph 190.12 (b).

Relative to implementation, a number of questions are raised in regard to enforcement. One example is the question of how the radiation exposure of a real person can be determined. This could involve such things as whole body counting, urinalysis, and a whole range of dosimetric problems.

In summary, it is believed that the technical bases and means of implementation of these proposed standards should be explored in a public rulemaking proceeding. Items including, overlapping of federal agency responsibilities, backfitting requirements, radioactive effluent control technology status, multiple unit sites and nuclear energy parks, relative risk assessments, and dose modeling should also be considered in detail in such a proceeding.

We thank you for this opportunity to comment on proposed 40 CFR 190.

Very truly yours,

H L Vener

H. L. Vener
Supervisor of Licensing

HLV:kf

Westinghouse Electric Corporation **Power Systems**

PWR Systems Division

Box 355
Pittsburgh Pennsylvania 15230

August 11, 1975
NS-CE-751

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
U. S. Environmental Protection Agency
Washington, D. C. 20460

Re: Environmental Radiation Protection
for Nuclear Power Operations --
Proposed Standards

Gentlemen:

This is in response to the Environmental Protection Agency's request for comments on the proposed standards for Environmental Radiation Protection for Nuclear Power Operations contained in 40 Fed. Reg. 23420, dated May 29, 1975.

Westinghouse concurs with the EPA that it is important to assure that our society is not burdened with unreasonable expenditures to minimize the potential risks of nuclear power operations in order to gain the necessary benefits of electric power. Therefore, we suggest that because of the substantive differences between the Nuclear Regulatory Commission's proposed Appendix I to 10 CFR 50 and the finalized version of Appendix I effective June 4, 1975 and the impact these differences will have on the cost-benefit analysis utilized by EPA in its Draft Environmental Statement, a reissue of the EPA's Draft Environmental Statement and proposed standards is necessary.

We do not feel that the EPA proposed standards are consistent with the NRC Appendix I. The NRC Appendix I sets separate design objectives on liquid and gaseous pathways and requires action to be defined if the actual quarterly releases exceed one-half the annual design objective. There is a distinct possibility that a licensee can be fully in compliance with the NRC requirements set forth in Appendix I, and at the same time and under the same circumstances be in violation of the EPA's proposed standards. The inconsistency between EPA and NRC regulations can be demonstrated via the following two scenarios:

(1) A two reactor unit site is releasing radioiodine in liquids and gases at such a rate that the first unit is just below the point where a course of action is required to be defined by Appendix I and the second unit is just above the design objective. Under Appendix I, operation could continue, status quo, indefinitely while the new EPA standard would require operation of one unit to be modified.

(2) A four reactor unit site is located across the river from a fuel reprocessing plant. The four reactor units are releasing radioiodine at the design objective limits in both gases and liquids while the reprocessing plant is operating at a level equivalent to twice the design objectives for LWR's. In this case, no action is required under Appendix I while:

    (a) the operation is 133% of the EPA standard only considering the four reactor units and,

    (b) the operation is ~200% of the EPA standard considering all the facilities.

The EPA standard would result in the NRC altering operation of the four reactor units without considering operation of the reprocessing plant. Additionally, NRC would be required to take further action to alter further operation of the reactors and/or to alter operation of the fuel reprocessing plant.

With the increased interest in multi-reactor sites and the urgent need for more fuel reprocessing plants, we feel that these scenarios could exist in the future. Therefore, we conclude that the two regulations are inconsistent.

Westinghouse urges that the required environmental impact statement and the proposed standards be redrafted to completely and accurately reflect the guidance for design objectives and limiting conditions for operation of light-water-cooled nuclear power reactors set forth by the NRC in the final Appendix I to 10 CFR 50. An additional reason for this recommendation is that in our view the standards proposed would require modification of the proposed Appendix I and the NRC methods of limiting effluent releases. Additional revision of Appendix I as a result of the proposed EPA standard will require the additional expense of time-consuming reanalysis. There are also decisions being made concerning the necessary equipment required to meet the as low as practicable criteria of Appendix I. The uncertainty involved in implementing the proposed EPA standard does not facilitate rendering such decisions. Issuance of the EPA standard in its present form and at this time would further impede the licensing process without significant benefits.

It is interesting to note that, in its finalized Appendix I, the NRC omitted that portion of its regulations relating to total quantities of radioactive material released in effluents--the rationale being that the more important consideration was the dose the individual might receive rather than the quantity of material released from the plant. We would recommend, therefore, that the EPA consider deleting the quantity limits specified in Section 190.10(b) of EPA proposed regulation in favor of a dose commitment concept.

Consistent with the EPA concern that society should not be excessively burdened with unreasonable expenditures to minimize potential risks, we would suggest that the nuclear power industry should not be subjected to potentially conflicting or inconsistent agency actions. We feel the implementation of the proposed standards will impose uncertainties, due to the inconsistencies in the numerical values of the terms to be used to calculate radiation doses in different parts of the fuel cycle. Westinghouse is aware that EPA in the past has utilized different dose conversion factors for relating air concentration of radioiodine to the dose received by an individual, neither of which is consistent with the values used by the NRC. The magnitude of the inconsistency between the different models is shown in the attached Table 1. Further illustration of the inconsistency between the EPA and NRC models is shown in Table 2. It should be noted that, with regard to the bone dose from the uranium in the water, the EPA model differs from the NRC model by three orders of magnitude. With respect to the lung dose from insoluble uranium in air, the EPA model differs from the NRC model by over one order of magnitude.

Since the NRC is responsible for implementation of the proposed standards, it should be made clear that the NRC dose conversion factors are applicable for determining compliance with the proposed standards. Thus, EPA should indicate its dose conversion factors are not applicable for determining compliance.

The basis of the potential health effects presented in the EPA Draft Environmental Statement are recommendations resulting from the low levels

of ionizing radiation given in the BEIR report. A more recent report, NCRP No. 43, on this subject considers the recommendations made by the BEIR committee and states, "The NCRP wishes to caution government policy making agencies of the unreasonableness of interpreting or assuming 'upper limit' estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption." We believe that, if EPA had considered the arguments presented in the NCRP report, the numerical dose limits contained in the proposed 40 CFR 190 standard may have been considerably higher.

On the basis of the above comments, Westinghouse believes that a new draft environmental impact statement should be prepared and the proposed standards reconsidered accordingly.

Because of the importance of any proposed changes in the radiation standards affecting uranium fuel cycle facilities, Westinghouse believes that the opportunity should be offered by EPA for a public hearing on the scientific and health factors upon which the proposed standards are based. Westinghouse would like to take this opportunity to indicate that it would be interested in participating, if such a public hearing is held. However, the extent of our participation would be dependent upon the nature and scope of the hearing and upon the disposition of the above-mentioned recommendations.

Should the EPA desire to pursue any of the matters contained herein, we would be pleased to discuss them with you. Thank you for this opportunity to participate in the rulemaking process.

Very truly yours,

C. Eicheldinger

C. Eicheldinger, Manager
Nuclear Safety Department

/smh

TABLE 1

MILK CONCENTRATION OF I-131 FROM GIVEN INPUT CONCENTRATIONS AND CORRESPONDING DOSES

(millirem/year per pCi/m^3 in air)

Age Grouping	EPA(1) Nuclear Fuel Reprocessing	EPA(2) Nuclear Power Reactors	NRC(3) Nuclear Power Reactors
Infant	2700	1700	3560
4 Yr. Old	Not Given	1900	1470
Adult	180	62	396

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(1) EPA-520/9-73-003-D, "Environmental Analysis of the Uranium Fuel Cycle Part III, Nuclear Fuel Reprocessing," October 1973, U. S. EPA, Washington, D. C.

(2) EPA-520/9-73-003-C, "Environmental Analysis of the Uranium Fuel Cycle, Part II, Nuclear Power Reactors," November 1973, U. S. EPA, Washington, D. C.

(3) WASH-1258, "Final Environmental Statement Concerning Proposed Rulemaking Action: Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Practicable' for Radioactive Material in Light-Water-Cooled Nuclear Reactors," Volume 2, Analytical Models and Calculations, USAEC (July 1973).

TABLE 2

COMPARISON OF EPA WITH NRC (ICRP-2) DOSE CONVERSION FACTORS FOR URANIUM

	Dose Conversion Factor	
Pathway	NRC Model*(4) (ICRP-2, 1959)	EPA Model, 1973(5)
Inhalation of insoluble U via air (lung dose)	$375 \frac{\text{mrem/yr}}{\text{pCi/m}^3}$	$10{,}000 \frac{\text{mrem/yr}}{\text{pCi/m}^3}$
Inhalation of soluble U in air (bone dose)	$150 \frac{\text{mrem/yr}}{\text{pci/m}^3}$	$150 \frac{\text{mrem/yr}}{\text{pCi/m}^3}$
Water ingestion of U (bone dose)	$7.5 \times 10^{-3} \frac{\text{mrem/yr}}{\text{pCi/liter}}$	$9 \frac{\text{mrem/yr}}{\text{pCi/liter}}$

*Values for NRC Model obtained by dividing maximum permissible does (MPD) by the maximum permissible concentration (MPC) based on ICRP-2 MPD and MPC values. $\frac{\text{MPD}}{\text{MPC}}$ for insoluble U in air = $\frac{15{,}000 \text{ mrem/yr}}{40 \text{ pCi/m}^3}$. 40 pCi/$m^3$ is utilized for low enrichment (2-4 w/o U-235) uranium. $\frac{\text{MPD}}{\text{MPC}}$ for U water ingestion = $\frac{30{,}000 \text{ mrem/yr}}{40 \times 10^{-6} \text{ pCi/1}} = 7.5 \times 10^{-3}$ pCi/1.

Comparable values for natural U would be twice as large since the MPC air and water values according to ICRP-2 are only half as large.

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(4) Health Physics, Vol. 3, pp. 1-380, June 1960, K. Z. Morgan, Editor-in-Chief.

(5) EPA-520/9-73-0038, "Environmental Analysis of the Uranium Fuel Cycle, Part I, Fuel Supply, October 1973, U. S. EPA, Office of Radiation Programs, Field Operations Division, Washington, D. C., Appendix A.

Carl L. Newman
Vice President

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August 11, 1975

Director, Criteria and Standards
  Division (AW-506)
Office of Radiation Programs
U.S. Environmental Protection
  Agency
Washington, DC   20460

Dear Sir:

Consolidated Edison Company of New York, (Con Edison) respectfully submits below its comments on proposed EPA regulations, 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations".

Con Edison recommends that the environmental radiation standards currently applicable to nuclear power plants and fuel cycle facilities not be changed unless and until EPA shows, based on a reasonable cost-benefit analysis, that such a change is in the public interest. For the reasons discussed below, we do not believe that in its proposal, EPA has made such a showing.

The Proposed Standards are Unnecessary

Con Edison believes that the currently applicable environmental radiation dose guidelines, as established by the Federal Radiation Council [F.R. Docs. 60-4539, 61-9402], have not been shown to present an unacceptable risk to the public health. Furthermore, there is ample evidence that doses to members of the public, due to sources other than natural background and medical and dental exposures, are significantly below these limits and will not approach them in the foreseeable future. For example, doses from power reactors are limited to a small fraction of the FRC guideline values by the regulations of the Nuclear Regulatory Commission (NRC). There is thus no urgent necessity for EPA to set new dose standards or allocate existing guidelines among the various sources.

While we believe that the allocation of environmental dose limits to various sources is a reasonable long-range task for EPA to undertake, we believe that the Agency's priorities are confused. EPA has commenced its task with the nuclear power industry and its fuel cycle components, a source of public radiation exposure that is currently subject to stringent regulation by an expert regulatory agency specifically established for that purpose. It would seem more appropriate to concentrate on establishing limits for exposure to radiation from radioactive materials and radiation sources not covered by the Atomic Energy Act and the Government Reorganization Act of 1974.

The Proposed Standards are Confusing

Although it is EPA's contention that its proposed standards are compatible with NRC's 10 CFR 50 Appendix I, we believe that the existence of two separate standards covering, in effect, the same facilities, can only cause confusion. Since EPA agrees that at present Appendix I is satisfactory to protect the public health, there is no need for establishment of an additional numerical standard for radiation from reactor effluents. The existence of this second set of standards adds a source of confusion and permits the litigation of any real or imagined inconsistency that may develop. We can discern no possible benefit to the public health of such a dual regulatory system. Furthermore, we believe that the NRC's orderly development of standards for the other components of the fuel cycle industry as it develops is a reasonable and safe approach to the regulation of such facilities, and that additional EPA limits are not needed at this time.

The Proposed Standards are not based on a Reasonable Cost-Benefit Analysis

The statement justifying the proposed EPA standards does not specify the methodology or data used to justify these standards from a cost-benefit standpoint. No evaluation of the benefits of nuclear power is presented. The rationale used is one of "cost-effectiveness." This method is useful for determining which of several alternative means is most effective in achieving a particular end. It does not, however, enable one to determine the reasonableness of the end.

EPA's analysis used is predicated upon a linear, non-threshold dose-effect relationship. In its report NCRP-43, the National Council on Radiation Protection and Measurements (NCRP) cautions governmental policy-making agencies "of the unreasonableness of interpreting or assuming 'upper limit' estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption". NCRP-43 also warns that "the use of over-estimates of risk for one alternative, e.g. one involving radiation exposure, unless counter balanced by commensurate overestimates of risks from other alternatives, could deny benefits to society and could conceivably incur greater risks in some circumstances". Although recognizing that sufficient data are not available to prove (or disprove) its assumptions, the EPA nonetheless states that its bases are "prudent". Furthermore, EPA seems to be using this basis as more than an "assumption", when it refers to radiation as "a non-threshold pollutant", without any qualifying phrase, in justifying its cost-effectiveness approach. Thus EPA, in attempting to establish the proposed standard, appears to be doing precisely what the NCRP cautioned against.

The National Academy of Sciences Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR) presented numerical estimates of carcinogenic risks at low doses and dose rates by extrapolation from the effects of large doses, delivered at high dose rates; such extrapolation was justified on pragmatic rather than scientific

grounds. The BEIR Report is referenced by the EPA in its standard, although references to reports with differing approaches are conspicuous by their absence. For example, the Report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) did not attempt such extrapolation, maintaining that the "estimates of risk per unit dose from epidemiological investigations are valid only for the doses at which they have been estimated . . .", and was not referenced by EPA. Similarly, there is no reference to NCRP-43.

The idea that radiation releases should be kept, "as low as practicable" is not in dispute, nor is the prudence of the assumption that there is no completely safe level of exposure to ionizing radiation. Cost-benefit analysis, however, should be based on realistic risk estimates at the exposure levels experienced. Since the possible expenditures involved for compliance and the risks of alternatives may be substantial, the usefulness of cost-benefit analyses to both society and industry is totally negated by the use of arbitrary, overly conservative risk estimates. The result is to deny society a substantial benefit.

Con Edison appreciates the opportunity to present its views to EPA. We hope that these comments will prove helpful to the Agency.

Very truly yours,

Carl L. Newman

CLN:rc

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BRACKLEY SHAW
OF COUNSEL

September 15, 1975

Director
Criteria and Standards Division
(AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Re: Proposed Standards for Environmental Radiation Protection for Nuclear Power Operations

Dear Sir:

On May 29, 1975, the Environmental Protection Agency (EPA) published in the Federal Register (40 Fed. Reg. 23420-25) a notice of proposed "Environmental Radiation Protection Standards for Nuclear Power Operations," inviting comment or suggestions on the proposed standards by July 28, 1975. The comment period was subsequently extended to September 15, 1975 (40 Fed. Reg. 34417) in response to requests from numerous interested persons.

These comments are submitted on behalf of the following named companies who to date have decided to consolidate

their participation in this rulemaking proceeding as a single Utility Group:

Alabama Power Company
Baltimore Gas and Electric Company
Boston Edison Company
Carolina Power & Light Company
Commonwealth Edison Company
Consumers Power Company
Duke Power Company
Duquesne Light Company
Florida Power & Light Company
Georgia Power Company
GPU Service Corporation
Long Island Lighting Company
Pacific Gas & Electric Company
Portland General Electric Company
Southern California Edison Company
Virginia Electric & Power Company
Wisconsin Electric Power Company
Yankee Atomic Electric Company

Appended to this letter as Attachments A and B are preliminary comments prepared by technical consultants to the Group. These comments are necessarily restricted to an outline of the material we will present at the public hearing concerning the impact and cost-effectiveness of the proposed regulation. Proper analysis of the proposed regulation is far too complex an undertaking to complete within the period allowed for comment. Further, we are badly handicapped in our analysis by the difficulties we have encountered in trying to relate the conclusions in the Draft Environmental Statement to the technical reports on which the Statement relies and by the errors and inconsistencies we find in these documents. In particular the underlying reports do not have an adequate identification of all of the release assumptions and dose calculational models and do not contain the intermediate calculations on which EPA's dose estimates and cost-effectiveness conclusions are based. As matters now stand, it will be necessary for us to reconstruct these calculations ourselves utilizing to the extent possible data developed in the course of NRC's Appendix I proceeding.

In addition to submitting these preliminary comments the Group wishes to question seriously not only the reasonableness but the timeliness of EPA's proposed standards and to make certain suggestions as to how further public participation in the rule-making proceeding might best be handled.

In Reorganization Plan No. 3, which became effective on December 2, 1970, EPA was charged with responsibility for the establishment of "generally applicable environmental standards for the protection of the general environment from radioactive material." EPA's initial public action carrying out this mandate has been its promulgation in May, 1975, of proposed "standards which would assure the protection of the general public from unnecessary radiation exposures and radioactive materials in the general environment resulting from the normal operations of facilities comprising the uranium fuel cycle."

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40 Fed. Reg. 23420. No adequate basis has been provided by EPA for either its selection of the uranium fuel cycle for initial standards-setting treatment, nor the need at this time for promulgation of standards for this source of radioactivity to the general environment.

Presently, the releases of all light-water nuclear reactors are subject to meeting the limitations expressed in Appendix I to 10 CFR Part 50 which quantifies the as low as practicable concept for radioactive releases from these facilities. Appendix I limits were derived after more than four years of rulemaking endeavors on the part of the NRC's (then the AEC's) regulatory staff, industry representatives, states and intervenor organization representatives. Central to Appendix I is the cost effectiveness of adding treatment systems on effluent streams to reduce the quantity of radioactive materials released--the same yardstick used by EPA to support its proposed standards. As to the remaining principal contributor of radioactive materials in the uranium fuel cycle sought to be covered by EPA's standards--the reprocessing segment of the fuel cycle--there are no such facilities presently operating in this country. When they do operate they will have been designed to meet the low-as-practicable requirements of 10 CFR 50.34a and 50.36a and will include most of the controls considered by EPA to be cost-effective.

Under these circumstances the need for immediate promulgation of EPA standards, especially standards which we believe are subject to severe criticism, must be questioned. We suggest the more prudent course of action for EPA is to defer action on the proposed regulation until it has a more solid basis for regulation in at least the following areas:

(a) It is essential that the plans for implementation of the EPA standards be formulated and made available for public comment prior to their adoption. Methods for allocating to the specific segments of the fuel cycle their allowable contribution to a generally applicable standard are crucial. Allocation may not prove necessary in the case of the 25 mrem individual dose limit, although consideration will somehow have to be given in licensing individual facilities to existing or potential dose contributions from other sources. Allocation will, however, be indispensable in administering the industry-wide limits on quantities of long-lived radioactive elements

per gigawatt of electrical generation. Absent any guidance on allocation, or implementation, no segment of the cycle is able to assess meaningfully its ability to comply with the standards. Even within one segment, take for example reactors, questions arise as to whether backfitting will be required, whether plants at a specific location will be judged on a first-come, first-served basis, how allowable variances will be established, and so on. Responsible governmental standards-setting cannot be conducted in a vacuum. It is incumbent upon EPA, which seeks to establish standards for industry on the basis of practicability and cost-effectiveness, to take into account whether those standards can realistically be implemented. We are aware in this regard of the problems experienced to date on the division of responsibilities between EPA and the regulating agencies such as NRC, and do not suggest that EPA should on its own develop and attempt to administer implementing regulations for its standards. It is our position, however, that EPA must consider the impact of its standards by evaluating, coincidentally with the establishment of the standards, the implementation schemes for applying those standards either by detailed assessment of existing regulations of the implementing agencies to determine the workability of the standards under existing regulations, or by coordinating with those same agencies for their coincident development of implementing regulations which will work. Further it is as important that interested persons be afforded an opportunity to participate in the formulation of implementation plans as in the standards themselves. Until implementation of the proposed standards has been given the requisite coincident attention, the validity of the standards and their practicability cannot be meaningfully measured. We urge EPA to coordinate with the implementing agencies before proceeding further in its present rulemaking endeavors.

(b) Appendix I to 10 CFR Part 50 was published in May of this year following an extensive, though disciplined, adjudicatory rulemaking proceeding. Many of the assumptions on which Appendix I is based, however, especially some of its source term assumptions as applied to very low level releases, remain to be tested. Operating experience testing those assumptions could be invaluable to consideration by EPA of "cost-effective" standards. So to will operating experience of reprocessing plants provide concrete data on releases from those facilities living under NRC's generally applicable as-low-as practicable standards. It is incumbent upon EPA to consider the benefit of applying this experience to the standard-setting process in relation to the establishment now of possibly unrealistic standards for want of such a data base.

(c) EPA's standards, as proposed, are based on unproven technology principally in the area of controlling releases from reprocessing facilities. Specifically, in the case of Kr-85, the practicability of attaining EPA standards assumes the commercial applicability of processes still in the pilot plant stage of development to large scale reprocessing plants. Based on this assumption (and the underlying assumptions of associated costs) EPA would establish standards now and postpone implementation until a date (1983) when that agency conceives the assumed technology should be available. By 1983 and for a number of years thereafter the contribution of Kr-85 from U. S. reprocessing plants to the atmosphere will be extremely small. We urge that EPA await the technological advances and that based on those technologies which prove themselves establish at that time standards which can be shown truly to be cost-effective. Similarly, EPA's approach to standards for specifically enumerated isotopes other than Kr-85, such as the transuranic elements, should await actual data not now available on the amounts of material actually released in operating facilities.

(d) EPA should await the results of several ongoing studies and regulatory developments before it proceeds further in the conduct of its own rulemaking endeavors. Among the more significant on-going reviews and proceedings is a study to determine the most appropriate methodology for the use of the cost-effectiveness approach in standards-setting, a sine qua non it would appear to the further expenditure of time and resources in this proposed rulemaking. The study is being conducted for EPA by the National Academy of Sciences. Release of the report of this study to EPA is anticipated by the end of this year (and release to the public one month later). The report should be reviewed and their results evaluated before proceeding further on the standards scheme presently proposed by EPA. Such a temporary stay in this proceeding will derive other substantial benefits which themselves should constitute cause for a minor postponement of these proceedings. Thus, during this period, NRC may commence its promised rulemaking to determine a cost per dose commitment standard for use in cost-benefit applications. This would provide further basis for the yardstick EPA should apply in determining cost-effectiveness.

(e) Promulgation of the proposed standards should await the NRC's GESMO proceeding and its determination with respect to the recycle of plutonium in light-water reactors. This determination will bear significantly on the need for and timing of EPA standards. In fact, if plutonium recycle is not permitted the fuel cycle on which EPA's proposed standards are based will simply not exist. Based on our estimate of future reprocessing costs it will not make economic sense to reprocess fuel solely for the sake of recovering uranium, and reprocessing plants will not be a factor

in the fuel cycle. Conversely, if plutonium recycle is allowed, it makes no sense to exclude from consideration, as the proposed standards now do, radioactive emissions associated with the use of recycled plutonium fuel.

(f) EPA has relied on a suspect application of the dose linearity concept to establish its radiation standards. Thus, through reliance on selected portions of the November, 1972, report by the National Academy of Sciences-National Research Council, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ionizing Radiation," EPA bases its standards on the assumption that the concept of dose-effect linearity is properly applied to extremely small variations in dose commitment. EPA, we believe, should reassess its reliance on the BEIR Report, bearing in mind that the BEIR report acknowledges the high probability that the linear hypothesis overstates the risk and the BEIR Committee admonition that "there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise, would clearly produce greater benefit." EPA should also factor in additional data which have become available since the BEIR Report and the 1972 United Nations report on ionizing radiation effects (the UNSCEAR Report) were published, and in particular, take into account the latest public pronouncement by the National Council on Radiation Protection in its Report No. 43 issued in February of this year. On calculating risk coefficients, the NCRP has cautioned:

> "The linear hypothesis, by its very nature, makes it possible to calculate risk coefficients, i.e., the number of cancers or other effects that would be expected to occur in an exposed population, of a given size, per unit of radiation dose. It must be emphasized, as noted earlier, that risk coefficients derived from the linear hypothesis are based on data obtained at high doses and high dose rates. The National Academy of

> Sciences (BEIR Committee), in its 1972 report, cautioned against the use of risk coefficients at doses and dose rates orders of magnitude lower than those at which observations were made. The United Nations Committee, in its 1972 report, expressed a strong opinion that the uncertainties in the linear hypothesis are such as to make it inadvisable to use risk coefficients except in regions where data exist. The evidence for both dose rate effect and departure from linearity are such that the NCRP believes that the concern expressed by each of the committees is warranted."

EPA cannot ignore this advice from a prominent standards-setting body. We urge EPA to elicit specific input from NCRP on the bounds of justified application of the linearity theory and to incorporate NCRP's and others' views on this subject before adopting its presently proposed application.

(g) To facilitate public comment on the proposed regulation and to provide a meaningful basis for a public hearing, EPA should supplement its DES with a complete identification of the source term assumptions, dose calculational models and intermediate calculations on which its dose estimates and cost-effectiveness determinations have been made. Only confusion and delay can result if participants in the public hearing are left to reconstruct these matters for themselves.

Before deciding the timing and format for EPA's planned public hearing, we suggest that EPA first provide through a preliminary hearing or less formal conference a further opportunity to all interested persons to discuss the matters of timing and format with EPA. Such a preliminary proceeding would not now deal with the substantive questions of the practicability of the proposed standards or their cost-effectiveness. It would instead be concerned with the comments made by this Group and others concerning the timeliness of the proposed standards. The questions to be considered would include the present need for the standards taking into account existing NRC regulations and possible gaps or deficiencies therein; the feasibility of adopting standards prior to the development of plans for their implementation; the possible advantages to be gained

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in accumulating further operating data, including the feasibility of new control technologies, on which to measure the practicability and effectiveness of the proposed standards; and the desirability of awaiting the outcome of further studies as to the validity of applying the linear dose hypothesis to very low levels of radiation. We believe that if these questions are not considered in some form of preliminary proceeding, argument on these questions will occupy a large part of the public hearing concerned with the substantive issues of practicability and cost-effectiveness of the proposed standards and divert needed attention to these subjects.

When the time comes for the main public hearing, we believe that careful attention should be given to formulating in advance clear and reasonably formal procedures for the hearing. We do not advocate, primarily because of the large number of participants, a full-blown adjudicatory process. We do believe that at a minimum EPA should make available for questioning its personnel who have been responsible for developing the proposed standards, who can explain their purpose and meaning, and who can speak to the detailed bases for the numerical values selected. To facilitate such questioning and to avoid duplication EPA might well ask that participants with common interests participate in the questioning through a panel approach. Following the public hearing EPA should also provide a mechanism, as did the NRC in the Appendix I proceeding, whereby the EPA Administrator looks to independent advisors for an objective evaluation of the record of the public hearing rather than to staff advocates of a particular position.

Sincerely,

SHAW, PITTMAN, POTTS & TROWBRIDGE

By George F. Trowbridge
George F. Trowbridge
Counsel for Utility Group

Attachments

Attachment A

PRELIMINARY TECHNICAL COMMENTS ON EPA PROPOSED RADIATION PROTECTION STANDARDS

The Proposed Standards Are More Restrictive Than Appendix I.

Although we understand it was not EPA's intent that the proposed limits be more restrictive than Appendix I, it is not, in fact, true. The proposed standards are more restrictive than Appendix I guides in several important ways, particularly for multi-reactor sites. This anomaly is quite likely due to the fact that EPA's proposed limits were conceived as being compatible with the final AEC (NRC) Staff position paper on Appendix I. A restructuring of the proposed limits to make them compatible with Appendix I as it was finally issued is very much in order, particularly so since both the proposed EPA limits and the NRC-issued Appendix I place so much stress on cost-benefit.

Appendix I permits a whole-body dose from gaseous releases of 5 mrem/year per reactor plus 3 mrem/year from liquids and specifically excludes direct radiation. The proposed EPA standards would limit the total body dose from all pathways from the entire fuel cycle to 25 mrem/year. The EPA limit includes direct radiation, whereas this pathway is specifically excluded in Appendix I. Furthermore the EPA limit of 25 mrem applies to organs other than thyroid and skin. For liquid releases, other organ doses are usually controlling. Appendix I permits 10 mrem/year dose to any organ from liquids from each reactor.

The inclusion of the direct radiation dose by EPA is of particular concern—the more so for BWR. The direct radiation dose from a BWR will, in many of not most instances, be quite significant relative to the proposed limit. The NRC review plan for Safety Analysis Reports includes a section on direct radiation dose assessments which includes dose assessment methods and acceptance criteria.[1] Acceptance criteria for general plant shielding and outside storage tanks are equivalent to 1 mrem/year at 500 m for each source. Upper and lower limit results from the NRC model for estimating turbine N-16 doses are shown in Figure 1. At 500 meters the annual dose is expected to range from 13 mrem to 240 mrem for full time exposure to one 1000 MWe BWR. A plant with a well-shielded turbine which gives an annual dose of 13 mrem is acceptable to NRC. Higher doses may be accepted if supported by cost-benefit analysis.

Doses from turbine building N-16 are not yet known very accurately. Results of calculations by Steyn et al[2] and measurements by Hairr et al[3] are included in Figure 1 for comparison. The lower bound NRC curve does not appear unrealistic.

It is evident from Figure 1 that the location of the nearest resident is crucial in determining the importance of direct radiation dose. Data on distances to nearest residences are also sparse, but data on distances to site boundaries of 64 sites have been summarized by NRC.[4] The average site boundary distance is 740 meters, but 10 of 64 sites have site boundary distances less than 500 meters.

It is concluded that the dose to a resident at 500 m from direct radiation from a 1000 MWe BWR would probably be in the range of 10-40 mrem per year, assuming full time exposure. If the nearest residence were more than 1000 meters from the plant, the dose would be less than 1 mrem per year. The direct radiation dose from a 1000 MWe PWR would be less than 2 mrem/year at 500 m, assuming full-time exposure. Allowing for a 50% shielding and occupancy factor the dose at 500 m would be about 1 mrem for PWR and 5-20 mrem for BWR.

Now combining all of the above, the dose to an individual residing in the immediate vicinity of a single 1000-MW(e) reactor which is meeting Appendix I limits in all respects could be:

Radiation Source	Dose Rate, mrem/year PWR	 BWR
Immersion (Noble Gas)	5	5
Liquid (Critical Organ)	10	10
Direct Radiation	~1	5-20
Total	~16	20-35

Thus for BWR a single reactor could use up or even exceed the entire EPA limit; a single PWR would use two thirds of the limit. The proposed limit is clearly more restrictive than Appendix I for multi-BWR sites, in fact, it is almost certain that additional, non-cost-effective equipment not required by Appendix I would be required if there were more than one BWR at a site and if the limits were adopted as proposed by EPA.

Whether or not multiple PWR could be placed at a single site would depend on what assumptions were made as to the additivity of doses from the multiple reactors. Traditionally NRC considers that multiple units are completely additive at the levels permitted by Appendix I. Utility applicants in considering the consequences of possible shutdown of generating capacity due to potentially exceeding the EPA limit would also be likely to make this same conservative assumption. It is our understanding that EPA may not have intended this to be the case (see page 40 of the DES). But the need for a clear spelling out of EPA's intention and of the inclusion of specific models for additivity is apparent.

It should be noted that the source terms, release path models, dose models, occupancy factors and other parameters needed to make dose calculations even for a single reactor are given in the DES and in the supporting technical documents only incompletely and in some instances in a contradictory manner. Models and methods for adding doses at multi-reactor sites are completely lacking. The DES should be supplemented by much more detail for the calculational models, inclusion of intermediate calculations, and a clear indication of how the transition is made from the backup technical documents to the DES. Failing this, it is the intention of the Utility Group to present detailed testimony at the public hearing on these proposed standards which will elaborate on the above points, suggest appropriate models and assumptions for use in adding doses at multi-reactor sites, and indicate what the dose limit (as proposed by EPA) would have to be in order that the limit will not be more restrictive than Appendix I.

Finally the DES includes two Tables (4 & 5) which purport to show that early all the current reactor applicants expect to meet exposure levels

below the proposed limit. Two points should be made concerning these tables. First, most of these applications were developed during the formative period of Appendix I and many include cost-ineffective control measures which are not required by final Appendix I. Second, the values quoted are from Environmental Impact Statements, not from Safety Analysis Reports. EIS are traditionally developed using source terms considerably lower than the SAR source terms. Selection of equipment to meet design objectives, during the licensing process, is always based on the higher SAR source terms. Thus the implementive effect of the proposed EPA limits must be judged based on SAR values, not EIS values.

Limits on Long-Lived Isotopes.

EPA has proposed limits on the release of long-lived isotopes from the entire fuel cycle as follows:

1)	Kr-85	50,000 curies/gigawatt-year(e)
2)	I-129	5 millicuries/gigawatt-year(e)
3)	Plutonium and other α-emitting transuranic isotopes with half-lives greater than 1 year	0.5 millicurie/gigawatt-year(e)

Quite apart from the unworkability of a system in which it would be necessary to establish an equitable allocation of the proposed limits* to the various parts of the fuel cycle, these limits are unnecessarily low, will be shown in the case of Kr and I to be grossly cost-ineffective, and in the case of the actinides may not even be attainable at any cost, let alone on a cost-effective basis.

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*Note that unlike the 25 mrem/year limit, which could be assumed to apply equally to all fuel cycle facilities, since in most cases the problem of overlap is almost non-existent, these quantity limits would have to be allocated since they are based on unit energy production, and are additive throughout the entire fuel cycle whether or not there is overlap of actual releases from any of the facilities.

The required processes for the removal of Kr and I are not now ready for commercial application to fuel reprocessing. They could not today be licensed by a commercial operation. To believe that they could actually be developed, licensed, designed, built, and put into commercial operation by EPA's 1983 deadline is wholly unrealistic. This date, 1983, is a good decade too early, both as to need and as to availability.

The proposed limit of 0.5 millicurie per gigawatt(e) year of transuranic alpha emitters with half-lives greater than one year is out of line with the experience of the only commercial reprocessing plant which has been operated to date in this country, i.e. the NFS West Valley plant, with the expectations of the two present reprocessors, and with the established permissible concentrations for the unrestricted release of these isotopes to air and water.

Comparison with MPC

There are about 30 tonnes of spent fuel discharged per year for each gigawatt(e). The pertinent transuranic content of this fuel is:

Isotope	Curies/gigawatt-year	% of Total
Pu-238	8.6E+04	45
Pu-239	9.7E+03	5
Pu-240	1.4E+04	7.3
Pu-241	6.0E 00	0.003
Pu-242	3.0E+01	0.015
Am-241	5.0E+03	2.6
Am-243	5.4E+02	0.28
Cm-244	7.6E+04	39.7
Total	1.9E+05	100

By way of illustration, an expanded West Valley plant, capable of handling 750 tonnes/year of fuel, would handle the fuel from 1/15 of a gigawatt(e) each day. Suppose the entire fuel cycle limit, 0.5 mC_i, were allocated to the liquid waste from that plant. Then the allowable release rate from that plant would be

$$\frac{0.5 \times 10^3}{15} = 33 \text{ microcuries/day.}$$

The effective MPC for the above mixture of transuranics is:

Isotope	% of Total	MPC $\mu C_i/cc$	Effective MPC $\mu C_i/cc$
Pu-238	45	5E-06	2.25E-06
Pu-239	5	5E-06	2.50E-07
Pu-240	7.3	5E-06	3.65E-07
Pu-241	0.003	2E-04	6.00E-09
Pu-242	0.015	5E-06	7.50E-09
Am-241	2.6	4E-06	1.00E-07
Am-243	0.28	4E-06	1.10E-08
Cm-244	29.7	7E-06	2.80E-06
			5.80E-06

Then the 33-microcurie/day limti would be diluted to drinking water MPC by a total flow of 200 cubic feet/day:

$$\frac{33\ \mu C_i/\text{day}}{5.8E\text{-}06\ \mu C_i/cc} = 5.7E{+}06 \text{ cc/day of water} = 200 \text{ cuft/day.}$$

The small stream which flows through the West Valley site, Cattaraugus Creek, has an average flow of 358 cfs. So the allowable release proposed by EPA would require the flow of that stream for just over half a second to dilute the entire allowable daily output (from the entire fuel cycle) to drinking water tolerance. This proposal by the Agency then is equivalent to reducing the existing MPC for the West Valley site by a factor of about 170,000.

Or similarly, assume that the entire fuel cycle limit of 0.5 mC_i were to be allocated to the gaseous discharge from West Valley. Again the allowable release would be the same 33 μC_i/day or 3.8E-04 μC_i/sec. The annual average X/Q at West Valley for their stack release is 7E-14 sec/cc. Then the average site boundary concentration of the transuranics would be 2.5E-17 μC_i/cc. This can be compared to effective MPC of

Soluble Isotopes	1.5E-13
Insoluble Isotopes	2E-12.

If the released material is insoluble, as it certainly will be, the effect of the 0.5 millicurie limitation is to reduce MPC by just about 100,000. Even if one were to use the soluble isotope MPC, the reduction factor is about 6000.

A similar calculation for the Barnwell plant gaseous discharge follows. Since Barnwell proposes to process 1500 tonnes of fuel/year (equivalent to 0.14 gigawatt-year/day) the allowable release, if the entire 0.5 millcurie were assigned to their gaseous release, would be 66 microcuries/day or 7.9E-04 μC_i/sec. The annual average X/Q for Barnwell is 2E-13 sec/cc. Thus the average site boundary concentration would be about 1.5E-16 μc/cc, so the reduction of MPC relative to the Barnwell site is about 12,000 for insoluble releases and about 1000 for soluble releases.

Operating Experience

It is also instructive to compare the proposed limit with actual operating experience at West Valley. During 1971, a year in which NFS processed the equivalent of about 0.8 gigawatt(e) of fuel the following liquid releases were measured at the discharge weir:

	Total Curies			
Time Period	Grossα	Pu-238	Pu-239	$\frac{\text{Pu-238+Pu239}}{\text{Gross}\alpha}$
First Quarter	-	0.015	0.002	-
Second Quarter	-	0.0011	0.0016	-
Third Quarter	0.009	0.00025	0.00036	0.067
Fourth Quarter	0.019	0.0014	0.00084	0.12
		0.0043	0.0048	

The total discharge of Pu-238 + 239 for the year was then about 9 millicuries. It would be expected that about twice this much total transuranic content was released, or about 20 millicuries from 0.8 gigawatt-year of production. This is about 50 times the proposed limit for the entire fuel cycle--from one single waste stream.

In 1968 and 1969, years in which NFS processed a total of about 1.5 gigawatt-year of fuel, and when they had only a single set of HEPA filters in their ventilation system, they released a total of about 40 millicuries of grossα--about 25 millicuries/gigawatt-year. If we assume that the ratio of transuranics to gross alpha is the same as noted above, about 0.2, then the release with the ventilation air was about 5 millicuries/gigawatt-year. Since 1969 NFS has had a second set of HEPA in the system. The gross alpha releases have dropped to about 1 to 2 millicurie/gigawatt-year and again, if the above ratio of transuranics to gross alpha holds, the release would be 0.2-0.4 millicurie/gigawatt-year--just barely below the entire fuel cycle limit for a single waste stream.

Prospective Reprocessors' Expectations

Consider now the performance which [illegible] predicts for its expanded and upgraded plant and also that predicted by AGNS, both as expressed in their SAR on the respective installations. NFS shows the following expected releases of the transuranic isotopes covered by the proposed EPA standard:(7)

Isotope	Liquid curie/yr	Gaseous curie/yr
Pu-238	5.7E-03	7.6E-03
Pu-239	5.9E-04	8.7E-04
Pu-240	8.9E-04	1.3E-04
Cm-244	0.13	2.5E-03
Am-241*	8.3E-03	1.6E-04
Am-243*	8.9E-04	1.8E-05
Total	146E-03	11.3E-03

*inferred by assuming same removal factors as for curium.

Thus from the processing of 25 gigawatt-years of fuel the liquid releases are expected to be 146 millicuries and the gaseous releases 11 millicuries. This is equivalent to

Liquid	6 millicuries/gigawatt-year
Gaseous	0.45 millicuries/gigawatt-year

AGNS, which plans to boil excess liquid up the stack and thus has no liquid discharges, expects the following gaseous emissions of the pertinent transuranics:(8)

Isotope	Gaseous curie/year
Pu-238	4.1E-03
Pu-239	3.8E-04
Pu-240	6.6E-04
Am-241	1.0E-03
Am-243	--
Cm-244	1.2E-02
Total	1.8E-02

Thus from the processing of 50 gigawatt-years of fuel AGNS expects to release about 0.35 millicurie/gigawatt-year.

Note that both AGNS and NFS predict they will be able to meet the proposed limit with their gaseous discharges, but just barely. Clearly almost the entire proposed limit would have to be assigned to the reprocessor leaving very little to be assigned to fuel fabrication and reactors. The wisdom a setting a limit so far below established MPC and so close to predicted performance capability when there is so little actual operating data and almost none based on full burnup fuel most indeed be questioned.

Miscellaneous Losses

Both NFS and AGNS predict that they may be able to release just under 0.5 mC_1/gigawatt-year from their controlled, treated ventilation releases. Neither has looked at the possibility of other miscellaneous releases, small by-passes which have always been trivial in relation to established MPC, but which become significant when measured against microscopic release limits based upon the presumed capability of treating the known and controlled waste streams. It is just this trap into which AEC fell in proposing

Appendix I limits in the first place. True, the air ejector off-gas, a small contained stream, can be treated to reduce its contribution to dose to values in the order of 1% of MPC. But once this controllable stream has been taken care of, miscellaneous losses which have always in the past been lost in the major release now become controlling. It is axiomatic that treatment of these miscellaneous losses is difficult, if possible at all, and most likely to be highly cost-ineffective.

We venture to predict that EPA is building just such a trap by setting a limit of 0.5 mC_i/gigawatt-year for transuranics. This limit is so low that very minor by-passes or miscellaneous losses would result in exceeding the proposed limit. For instance, the dissolver solution at a reprocessing plant has the following approximate concentration of the pertinent transuranic isotopes:

Isotope		Dissolver Solution Concentration millicuries/cc
Pu-238		7.2E-01
Pu-239		8.1E-02
Pu-240		1.2E-01
Am-241		4.2E-02
Am-243		4.5E-03
Cm-244		6.4E-01
	Total	1.6E 00

Thus if NFS were to lose control of the equivalent of 8cc in a year due to spills of samples, by-passes of filters, leaks to unventilated areas, etc, they would have exceeded the entire annual limit for the entire fuel cycle for 25 gigawatts. The loss of such a small quantity in miscellaneous ways would seem to be almost a certainty. In any event, efforts (which have not been made to date) should be made to obtain actual operating data on such miscellaneous losses before so low a limit is set.

Reactors

Unless reactors are specifically excluded from consideration in determing the fuel-cycle contribution of transuranics, they cannot simply be dismissed as not contributing any significant amount of transuranics. They too will have to face this limit. As we have seen by far the bulk of the limit will have to be assigned to the reprocessor. But something will have to be assigned to the reactor. Suppose as much as 5% were assigned to the reactor. Assuming it is a 1000-Mw(e) unit, its allowable discharge for the entire year would be 25 microcuries! Let us assume that half of this is assigned to gaseous releases and half to liquid releases. Also assume that the average ventilation flow is 150,000 CFM and the annual discharge of liquids is 150,000 gal. The concentrations which would then have to be measured in the vent release and the liquid releases in order to prove compliance are in the range of:

Gases	5E-15 μc/cc
Liquids	2E-08 μc/cc

To measure such low levels on a routine basis (particularly the gases) is going to be extremely difficult at best and may be impossible particularly in view of the fact that there will be four times as much Cm-242 as the total of the applicable transuranics which would have to be subtracted out from the gross counts.

Cost Effectiveness

The Agency states (on FR page 23421) that "such a limit (25 mrem/year) is readily satisfied at all sites...by levels of control which are cost-effective...". The Agency also states (FR page 23422) that "the proposed limits on long-lived isotopes can be met at a cost of less than $75 per person-rem."

Neither statement is correct and in our detailed testimony to be presented at the public hearing we propose to go extensively into cost-effectiveness analyses.

Fundamentally we believe that the Agency has consistently understated costs and overstated benefits. As a result the cost-benefit ratios, and the resulting claims of cost effectiveness of control measures, are in many instance grossly in error.

Figures 3 & 4 of the Draft Environmental Statement purport to depict the cost effectiveness of the more than three dozen control measures which EPA examines. In a sense they do but these figures suffer from the following deficiencies:

1) The DES contains no detailed backup table for Figures 3 & 4. Likewise it contains no discussion whatsoever to indicate how the exhibits of the DES were obtained from the three-volume technical document (PB-235-804, -5, & -6) upon which the DES is based. Since these technical documents are incomplete and riddled with errors and inconsistencies, it becomes a Herculean task to attempt to cross check the information presented in the DES.

2) While EPA avoids some of the worst offenses of the AEC Staff in their early presentation of "cost-benefit" analyses, they still persist, as in the case of liquid radwaste systems for reactors for example, in lumping a number of treatments together into a single "case" so as to hide the incredibly poor cost effectiveness of some of the components of those cases.

3) These figures (3 & 4) are in error in that the "zero" point, mislabelled "no control," is plotted at a cost of zero, whereas in actuality this base case has already spent 6 million (present worth) 1970 dollars for the BWR case and 2.0 million 1970 dollars for the PWR case.

4) The inclusion of the "cost of electricity to consumer" in mills/Kwh(e) obscures the very large sums of money involved. All kinds of nonsense can be "justified" on the basis that it "adds little to the cost of power in mills/Kwh."

5) There is no indication on either figure that nearly all "cost-effective systems" even as defined by the EPA's own calculations (with which we have serious quarrel) are now, and have been for a long time, standard industry practice. The implication is strong that all of these things will be brought about by the EPA proposed standard—and this is simply not true.

Figure 12 of the DES lists 22 items which EPA claims are required to meet the proposed standard for PWR. These are listed in attached

Table 1. Of the 22 items only eleven are cost effective even by EPA's own definition (with which we disagree both as to cost and benefit). Of these 11, 9 are already industry practice. The two which are not are both related to reprocessing plants and will be discussed later.

Eleven of the required controls are not cost-effective even by EPA's own values. Of these eleven non-cost-effective controls, industry is already using seven, despite their lack of cost-effectiveness.

There are six control measures which are not present industry practice—two which EPA claims are cost-effective (and we dispute) and four which even EPA does not show are cost-effective—which would be required by the proposal. The total annual cost of these six control measures which are not now used by industry is (using EPA costs)

	$		$
Kr-85 removal	1,400,000/reproc plant*	=	33,000/gigawatt(e)
Ag Zeolite	225,000/reproc plant*,**	=	5,000/ "
Liquid PWR-3	115,000/reactor	=	115,000/ "
2nd bag filter	1,500/conversion plant	=	50/ "
HEPA drying	1,500/mill	=	300/ "
2nd bag filter	23,000/conversion plant	=	850/ "
			~ $155,000/gigawatt(e)

Our preliminary analysis of the PWR cases listed on Figure 12 of the DES (an analysis which will be detailed and extended in our Hearing testimony) indicates that, for a single PWR at a site, the gaseous requirements of the EPA proposal would appear to be incompatible with Appendix I so long as NRC did not adopt EPA organic iodine dose models. For liquids, however, this is not the case. EPA makes the same mistake that was used in the Appendix I Draft Environmental Statement, i.e., setting up a completely unrealistic system as a "base." In addition none of the EPA PWR liquid cases have any real meaning since they treat clean and dirty wastes together in a single system—which is not general PWR practice. Finally the whole EPA analysis obscures the terribly poor cost-effectiveness of some of the components since between their cases 2 and 3, three equipment pieces are added; between cases 3 and 4, five pieces are added. Our preliminary evaluation of the PWR liquid control measures suggests the following.

Waste Stream	Required by EPA (Fig 12, DES)	Required by Appendix I
Clean Waste	Evaporator, Demineralizer	Evaporator
Dirty Waste	Evaporator, Demineralizer	Two Demineralizers
Steam Generator Blow-down	Two Demineralizers	One Demineralizer (River) Nothing (Lake & Seacoast)
Turbine Bldg Drains	No Treatment	No Treatment
Laundry Wastes	No Treatment	No Treatment

It is hard to see how EPA justifies their control measures, but assuming that the DES is correct (in this instance) then the additional liquid treating equipment required for a single unit—let alone a multi-reactor site—which the EPA proposal would require over that required by Appendix I would cost over $100,000/year for each reactor.

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* Cost multiplied by 1.45 to bring to 1975 dollars.

** Does not include large unknown operating costs.

Figure 12 of the DES also lists 23 items which EPA claims are required to meet the proposed standard for BWR. These are listed in attached Table 2. Of the 23 items only twelve are cost-effective even by EPA's own definition. Of these twelve, all but the two associated with reprocessing are already industry practice. Eleven of the required controls are not cost-effective even by EPA's own values. Of these eleven non-cost-effective controls, industry is already using 6 1/2, despite their lack of cost-effectiveness.

There are 6 1/2 control measures which are not present industry practice—two which EPA claims are cost-effective (and we dispute) and 4 1/2 which even EPA does not show are cost-effective—which would be required by the proposal. The total annual cost of these 6 1/2 control measures which are not now used by industry is (using EPA costs—corrected to 1975 dollars)

Kr-85 removal	$ 1,400,000/reproc plant	=	$ 33,000/gigawatt(e)
Ag Zeolite	225,000/reproc plant	=	5,000/ "
2nd bag filter	1,500/conversion plant	=	50/ "
HEPA Drying	1,500/mill	=	300/ "
2nd bag filter	23,000/conversion plant	=	850/ "
Evaporator (Detergent)*	50,000/reactor	=	50,000/ "
Clean Steam to Turbine Valves	150,000/reactor	=	150,000/ "
		~	$ 240,000/gigawatt(e)

* The 1/2 case.

Our preliminary analysis of the BWR cases listed on Figure 12 of the DES (an analysis which will be detailed and extended in our Hearing testimony) indicates that, for single BWR at a site, the gaseous requirements of the EPA proposal would appear to be compatible with Appendix I, again so long as NRC did not adopt EPA organic iodine dose models. For BWR liquid cases, the EPA and Appendix I requirements are closer together than in the case of the PWR liquids. In fact, if EPA had not obscured the terribly poor cost-effectiveness of evaporating detergent waste by combining this step with the ion exchange treatment of the Low Purity Waste, they would probably have come to the same conclusions as were arrived at in the Appendix I Hearings. Our preliminary evaluation of the BWR liquid control measures suggests the following.

Waste Stream	Required By EPA (Figure 12, DES)	Required by Appendix I
High Purity	Ion Exchange	Ion Exchange
Low Purity	Ion Exchange	Ion Exchange
Chemical	Evaporation	Evaporation
Detergent	Evaporation	No Treatment

The additional cost which EPA indicates would be required for liquid treating equipment would be about $50,000/year.

Overall then the non-cost-effective equipment called for by the EPA proposal would cost about $185,000/year per reactor. For 100 reactors this amounts to about 18 million dollars per year.

All of the comments to date are based on the EPA's own figures--both cost and benefit. And we take strong exception to their calculations of both costs and benefits (dose reduction).

We do not have too much quarrel with EPA's basic cost estimates for cases involving reactors. They seem to have started with costs developed during the Appendix I hearing. We have made comparisons of the costs presented by the Consolidated Utility Group in the Appendix I hearing with EPA's costs and they compare reasonably well--much better than they do with the AEC Staff costs in the Appendix I hearing. For the fuel supply and fuel reprocessing, however, their costs have to be at least 40% low since they all are in 1970 dollars. Furthermore the backup for most of these costs are 1960 references. The 1960 dollars were converted to 1970 dollars by multiplying by about 1.25--perhaps a bit low. The real question is whether 1960 estimations--many based on papers from Harvard--have any validity today.

A more fundamental objection to their cost treatment is that, although they calculate doses for 130 years, they present worth costs at 7 1/2% which in effect sums the annual costs for only 11.8 years. We do not believe this is a valid approach, we believe that the total costs for the thirty years of operation should be summed. Thus we believe that EPA understates the cost by a factor of 2.5. Coupling this with a factor of 1.45 which we used to convert 1970 dollars to 1975 dollars leads us to the conclusion that all of their costs are low by a factor of almost four.

As we indicate in more detail in another section of these comments, we also quarrel seriously with the EPA approach to the calculation of "benefit". The population dose concept, measured in man-rem, is at best only a device for aiding in the decision process as to the cut-off point for further expenditures for control measures. If extended indefinitely in time and space,

it must inevitably approach the mathematical absurdity of multiplying an infinite (population) be an infinitesimal (dose) resulting in a purely indeterminate and meaningless product. The cost-benefit approach used by NRC, which arbitrarily cuts off the population at 50 miles, and calculates the dose based on the last operating year of the plant so as to maximize the effect of buildup of long-lived emissions puts a rational limit on both the population and on the dose to the least exposed member of the population at risk. To this approach could reasonably be added a 50-year dose commitment from internal emitters. The product of such a calculation may have some validity for the decision making process. The product obtained by EPA, when they use the population of the entire world and calculate the dose over 130 years (the rationale for the cutoff at 130 years is not clear--why not 15 trillion years when the sun is supposed to give out?) is completely meaningless.

The absurdity of the EPA approach vis-a-vis that of NRC is well illustrated by comparing the cost-benefit calculations for Kr-85 removal at reprocessing plants. EPA claims that Kr-85 can be removed at a cost of about $75/man-rem. A cost-benefit calculation of this control measure using the NRC approach leads to the following.

The annual discharge of fuel associated with 1 gigawatt(e) is about 30 tonnes containing about 10,000 curies Kr-85 per tonne. Therefore about an 85% removal of the Kr-85 would be required tc meet the proposed Kr-85 limit. There are no demonstrated processes to do this on a commercial basis but there are processes which have been demonstrated on a pilot plant basis. Such a process is the "Voloxidation Process"* under development at Oak Ridge. A capital cost estimate for installing such a process at the West Valley plant has been made (ORNL-TM-4409, "Fission Product Gas Retention Study", North and Booth, August, 1973) and the suggested capital cost for the Kr-85 portion of the system, which is undoubtedly low, is $4,000,000. If this is annualized with a fixed capital charge of 25% and a reasonable estimate of the annual operating costs is made, a total annual cost of about $3,000,000 is obtained. (EPA on a comparable annualizing basis allows only about $300,000/year, so their costs are about a factor of ten low.) The West Valley SAR(7)(9) indicates that the whole-body dose produced per curie of Kr-85 released is about 5E-07 man-rem/curie and the total population dose is 4.3 man-rem/year. Thus the cost benefit ratio for 85% removal of Kr-85 at West Valley would be

$$\frac{3E+06}{4.3 \times 0.85} = \$800,000/\text{man-rem}.$$

This is just about a factor of 1000 higher than that claimed by EPA. This anomalous result is the product of their understatement of costs (by a factor of ten) and their vast overstatement of "benefits" by playing numbers games with time and space. There is no doubt that the man-rem can be vastly inflated by playing numbers games. But by the time the NRC 50-mile radius has been reached the individual whole-body dose has dropped to the order of 0.001 mrem/yr--a value equivalent to the increase in natural background due to an increase in elevation of about 2 inches. The numbers one can obtain by multiplying meaningless small numbers by very large populations are themselves meaningless and should not be used to justify saddling an industry with unnecessary limits and the populace with unnecessary costs.

The cost benefit claims for I-129 removal suffer from the same deficiencies as the Kr-85 claims. Again calculations done for West Valley indicate that the annual dose from the release of I-129 (within 200 miles in this case since over this distance essentially all of the iodine will have deposited on the ground) is about 15-man-thyroid rem/curie (the whole-body dose would be about 1% of this). The fuel from one gigawatt(e) will contain just about one curie of I-129 so its essential removal (to 5 millicuries) will result in the elimination of about 15 MTR. There is little likelihood that this can be done for less than say $100,000 so the cost per MTR is over $6500--again a far cry from $75. Again the value of the operation can be inflated by assuming the eventual exposure of more and more people as the small amounts of I-129 move through the environment; but the dose levels must perforce be more trivial than was the case for Kr-85. And again the numbers game produces a meaningless number.

Removal of Kr-85 and I-129 are the two control measures of the six mentioned earlier, which are not now industry practice, and which EPA claims are cost-effective. We state flatly that they are both grossly cost-ineffective and should be eliminated on that basis alone, quite apart from the fact that the technology for the removal of either is a long way from being demonstrated.

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*This process also is useful in removing iodines and tritium.

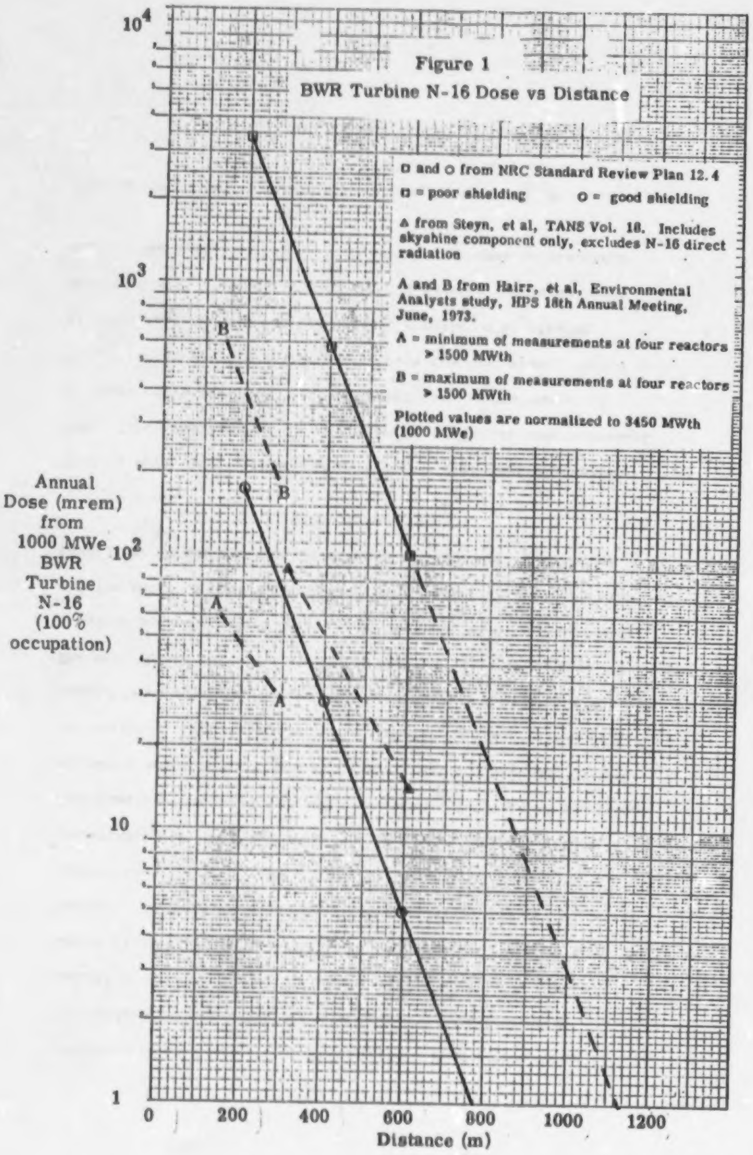

Figure 1

BWR Turbine N-16 Dose vs Distance

Table 1

EPA Required Cases for PWR (see Figure 12)

	Control		Industry Practice	EPA Cost Per Health Eff ($1000)	Cost Effective By EPA Definition
1	HEPA	Fuel Fab	Yes	1.1	Yes
2	HEPA's(2)	Reproc	Yes	1.1	Yes
3	Liquid Case PWR-2	Reactor	Yes	3.0	Yes
4	Bag Filter	Conv (WS)	Yes	7.3	Yes
5	Iodine Scrub	Reproc	Yes	11.5	Yes
6	Settling Ponds	Enrich	Yes	24	Yes
7	Kr-85 Removal	Reproc	No	42.5	Yes
8	Bag Filter	Conv (HF)	Yes	47.5	Yes
9	Ag Zeolite	Reproc	No	54.4	Yes
10	Bag Filter(drying)	Mill	Yes	52	Yes
11	Settling Ponds	Conv (WS)	Yes	67	Yes
12	Holding Pond	Conv (HF)	Yes	280	No
13	Liquid Case PWR-3	Reactor	No	2400/260	No
14	Clay Cure Dam	Mills	Yes	440	No
15	2nd Bag Filter	Conv (WS)	No	785	No
16	Settling Tanks	Fab	Yes	1235	No
17	15-Day Gas Holdup	Reactor	Yes	960	No
18	HEPA Drying	Mills	No	1430	No
19	Bag Filter(crush)	Mills	Yes	4000	No
20	2nd Bag Filter	Conv (HF)	No	5200	No
21	Seepage Return	Mills	Yes	6700	No
22	Iodine Case PGIE-3	Reactor	Yes	800	No

Table 2

EPA Required Cases for BWR (see Figure 12)

	Control		Industry Practice	EPA Cost per Health Effect ($ 1000)	Cost Effective by EPA Definition
1	HEPA	Fuel Fab	yes	1.1	yes
2	HEPA's (2)	Reproc	yes	1.1	yes
3	Bag Filters	Conv (WS)	yes	7.3	yes
4	Iodine Scrubber	Reproc	yes	11.5	yes
5	Settling Pond	Enrich	yes	24	yes
6	Liquid Case BWR-2	Reactor	yes	31	yes
7	Kr-85 Removal	Reproc	no	42.5	yes
8	Bag Filters	Conv (HF)	yes	47.5	yes
9	Ag Zeolite	Reproc	no	54.4	yes
10	Bag Filter (U_3O_8)	Mill	yes	52	yes
11	Settling Pond	Conv (WS)	yes	67	yes
12	10-day Xe Charcoal	Reactor	yes	100	yes
13	20-day Xe Charcoal	Reactor	yes	1,000	no
14	Holding Pond	Reproc	yes	280	no
15	Clay Core Dam	Mill	yes	440	no
16	2nd Bag Filter	Conv (WS)	no	785	no
17	Settling Tanks	Fuel FAB	yes	1,235	no
18	HEPA (drying)	Mill	no	1,430	no
19	Bag Filters (crush)	Mill	yes	4,000	no
20	2nd Bag Filter	Conv (HF)	no	5,200	no
21	Seepage Return	Mill	yes	6,700	no
22	Liquid Case BWR-3	Reactor			
	Demin-Dirty		yes	2,850	no
	Evap-Laundry		no	3.6E+06	no
23	Iodine Case BG1 E-2	Reactor	no	5.4E+06	no

References

1. U.S. Atomic Energy Commission, Standard Review Plan, Section 12.4, "Dose Assessment," 1975.
2. Steyn, Julian J., R. Huang, and H. P. Yule, "Reactor Site N-16 Skyshine Dose Rate, "Transactions of the American Nuclear Society, Volume 18, June, 1974.
3. Hairr, L. M., P.C. LeClare, T. W. Philbin, and J. R. Tuday, "The Evaluation of Direct Radiation in the Vicinity of Nuclear Power Stations," presented at the Health Physics Society annual meeting, June, 1973.
4. U.S. Atomic Energy Commission, "Final Environmental Statement Concerning Proposed Rule Making Action, Numerical Guidelines for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as Practicable' for Radioactive Material in Light-Water Cooled Nuclear Power Reactor Effluents," WASH-1258, 1973.
5. Nuclear Fuel Services, Inc, Safety Analysis Report, Docket 50-201, Table X-2-2.
6. Allied General Nuclear Services, Safety Analysis Report, Docket 50-332, Table 2.1-4A, Appendix J.
7. loc cit Table X-2-1
8. loc cit Table 2.1-1, Appendix J
9. loc cit Table X-2-7

B. COMMENTS ON EPA RISK ANALYSIS

The proposed regulation derives from an attempt to balance the cost of control measures against the cost of health effects prevented by the control measures. In relating anticipated health effects to doses, EPA uses the results of the National Academy of Sciences BEIR (Biological Effects of Ionizing Radiation) report of 1972(1). The BEIR report estimates health risks from radiation exposure at low doses and dose rates by linear extrapolation of the only available empirical results which were obtained at doses 2-3 orders of magnitude above doses of interest and dose rates 8-9 orders of magnitude higher than dose rates of interest.

The linear extrapolation has been used by authoritative bodies in the past to derive conservative estimates of risk from radiation exposure to aid in establishing maximum permissible doses(2, 3). The recognition that a no-threshold hypothesis may accurately reflect the dose-response relationship is the basis for these bodies' recommendations to keep doses as low as practicable, readily achievable, or reasonably achievable(2, 3).

The BEIR Committee adoption of the linear hypothesis to quantify risk from low level radiation exposure resulted from a perceived need for quantitative analysis to determine the limits of practicability. The Committee recognized that the calculated risks are subject to considerable uncertainty and that risks associated with low level radiation exposure may be zero. The fact that a proven alternate relationship does not exist and the fact that the linear relationship simplifies quantitative estimation of risk were important in the Committee adoption are evident in the following quote from BEIR:

> "In view of the gaps in our understanding of radiation carcinogenesis in man, and in view of its more conservative implications, the linear, nonthreshold hypothesis warrants use in determining public policy on radiation protection; however, explicit explanation and qualification of the assumptions and procedures involved in such risk estimates are called for to prevent their acceptance as scientific dogma. Futhermore [sic], the linear hypothesis is the only one which permits the selection of the mean accumulated tissue dose to characterize the radiation exposure of a group under conditions of nonuniform exposure and exposure rate. The mean accumulated tissue dose is the only practical quantity that can be used to estimate the risk of cancer in such populations until the influence of the many interacting variables can be better specified."(1)

(It is worthwhile to note, at this point, that EPA documentation supporting the proposed rule is sadly lacking in "explanation and qualification . . . to prevent [risk estimate] acceptance as scientific dogma.")

In a report published at about the same time as the BEIR report, UNSCEAR (United Nations Scientific Committee on the Effects of Ionizing Radiation) presented results of analyses of individual and population dose commitments from each of a variety of sources, and, for comparison, included the annual dose to an individual from natural radiation(4). The NCRP (National Council on Radiation Protection and Measurements) has published a review of the BEIR and UNSCEAR reports and identifies the reasons for UNSCEAR rejection of the linear hypothesis for low level radiation exposure risk estimation:

> "Both Committees (BEIR and UNSCEAR) recognized that the neutron RBE varies with dose in most biological systems, and they both pointed out that it may well vary with dose in the Hiroshima and Nagasaki A-bomb survivor data. However, the reports of these Committees come to different decisions concerning the utilization or disposition of this knowledge. This is an important difference because data from the atomic bomb survivors in Hiroshima (where neutron radiation was predominant) and in the smaller study population in Nagasaki (where only gamma radiation was important) form a major basis for carcinogenic risk estimates for low-LET radiation.
>
> "The BEIR committee assumed that the dose-effect relationships for carcinogenesis among survivors of either or both of these two cities may be linear. The BEIR Report compared the data from the two cities by means of the simplifying assumption of a mean neutron RBE of 1 or 5, independent of dose. The Report recognized that this treatment of the data might seriously underestimate the

neutron RBE and overestimate the gamma radiation risk at low doses and dose rates, but that firm data enabling other approaches were lacking. The UNSCEAR arbitrarily chose neutron RBE values varying from 10 at low doses to 1 at high doses in the range of observation.

"The limitations imposed by UNSCEAR in its approach to risk estimation may be represented by the following excerpt from its 1972 Report (page 403, paragraph 6 of reference 4):

> 'Estimates of risk per unit dose derived from epidemiological investigations are valid only for the doses at which they have been estimated and they can be applied to a range of doses only if there is a linear relationship between dose and incidence since extrapolations beyond that range may lead to gross errors. Particular care should be exercised in estimating risks from data on people exposed to mixed neutron and gamma radiation. Radiobiological experiments indicate that the RBE of neutrons varies with dose (see annex G) so that, if these results are applicable to human beings, the incidence of various effects cannot be proprotional [sic] to absorbed dose for both gamma rays and neutrons and estimates of risk in terms of incidence per unit dose need to be clearly qualified.'

"The UNSCEAR Report stressed the uncertainty of extrapolations of available data to low radiation levels, does not attempt such extrapolations, and indicates the need for consistency between conclusions drawn from epidemiological data and established general findings in radiobiology, making a special point in this connection concerning the functional relationship between RBE of high-LET radiation and dose and dose rate. The UNSCEAR Report indicated that the data from Hiroshima, involving mixed gamma and neutron radiations, and the uncertainty of the neutron RBE at low radiation levels, constitutes a strong argument against extrapolation from these data obtained at high doses and dose rates to estimate even upper limits of risk at low doses and dose rates, especially for low-LET radiation." (5)

In the DES supporting the proposed rule-making, EPA acknowledges a double-edged responsibility:

> "It would be irresponsible to set standards that impose unnecessary health risks on the public (unnecessary in the sense that exposures permitted by the standards can be avoided at a small or reasonable cost to the industry), and it would be equally irresponsible to set standards that impose unreasonable costs on the industry (unreasonable in the sense that control costs imposed by the standards provide little or no health benefit to the public)." (6)

Previously noted criticisms of the use of the linear hypothesis indicate that the health benefit to the public may be less than anticipated by EPA and may, in fact, be zero. But even if one accepts the linear hypothesis, the EPA balance of the value of anticipated cumulative health effects against costs of control measures without consideration of relative risk (health effect probability from radiation exposure relative to other causes) appears questionable.

In the BEIR report, NAS has suggested that relative risk is an important consideration:

> "The public must be protected from radiation but not to the extent that the degree of protection provided results in the substitution of a worse hazard for the radiation avoided. Additionally there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise, would clearly produce greater benefit." (1)

Similarly, the ICRP (International Commission on Radiological Protection), in recommending the use of a cost-effectiveness approach similar to that used by EPA, cautions against ignoring the consideration of relative risk:

> "The concept of population dose (or collective dose) in man-rems has been widely used as a measure of the total detriment either to a whole population, or to a group of people, who may be workers or members of the public. Its use in this way is valid only for a linear, non-threshold dose-risk relationship, independent of dose rate. Even granting these conditions, it requires some modification in practice.

> "The use of the concept of population dose in the process of decision-making should, therefore, be supplemented by consideration of the dose to individuals. At low levels of individual dose, e.g. those small by comparison with variations in local natural background, the risk to the individual is so small that his health and welfare will not be significantly changed by the presence or absence of the radiation dose. At levels of individual dose close to the relevant dose limits, the need to avoid occasional excessive doses, the restrictions imposed by regulatory bodies and the desire to reduce the radiation risk to individuals well below that to which they are otherwise exposed, mean that more effort has to be applied in practice to dose reduction than would be expected from consideration of the collective dose alone." (3)

NCRP considers the risk estimates based on the linear hypothesis of "marginal value" at best for purposes of realistic risk-benefit evaluation and concludes that numerical risk benefit balance is not yet useful because of the large uncertainties involved. NCRP also cautions against ignoring relative risk:

> "In risk-benefit analysis for purposes of decision-making, numerical estimates of radiation-related risks, even when realistic, are of little use in a vacuum, i.e., without comparable numerical estimates of associated benefits, and of risks and benefits for alternative means to achieve the desired ends. When it becomes possible to analyze, quantify and weigh in the balance numerically the risks, benefits and costs of activities involving desirable or undesirable radiation exposure, on the one hand, and alternative means to desired ends on the other hand, the use of overestimates of risk for one alternative, e.g., one involving radiation exposure, unless counterbalanced by commensurate overestimates of risks from other alternatives, could deny benefits to society and could conceivably incur greater risks in some circumstances.
>
> "Before considering any further restriction of radiation protection standards, it is important to attain realistic values for risks and benefits, for weighing risks and benefits in decision-making, and for the most effective application of the principle of 'lowest practicable level'. This approach is important in order to avoid the expenditure of large amounts of the limited resources of society to reduce very small risks still further with possible concomitant increase in risks of other hazards of consequent lack of attention to existing greater risks." (3)

Consideration of EPA results suggests that EPA is proposing to reduce risks which are currently low and which may be expected to remain low through the year 2000. Table 1 contains estimates of risks to an individual in the year 2000 from Kr-85, I-129, and long-lived transuranic alpha-emitters discharged in the period 1970-2000. Risk estimates are based upon EPA load projections, transport models, and risk coefficients derived from BEIR. The cancer death risk from natural background radiation is included for comparison. Risks from other sources are given in Tables 2 and 3. It is apparent that risks from uranium fuel cycle operations are orders of magnitude lower than most other risks.

Table 1

Risk to Individual in Year 2000 from Effluents from Uranium Fuel Cycle from 1970-1999 and Natural Background Radiation(1)

Source	Risk per Year	
Cancer Death from Krypton-85(2, 3)	1.4×10^{-9}	1 in 710, 000, 000
Genetic Damage from Krypton-85(2, 4)	2.4×10^{-9}	1 in 420, 000, 000
Thyroid Cancer from Iodine-129(5, 6)	1.5×10^{-8}	1 in 70, 000, 000
Lung Cancer from long-lived alpha emitting isotopes of plutonium, americium, and curium(7)	1.4×10^{-10}	1 in 7, 100, 000, 000
Cancer from natural background radiation (assumed 100 mrem/yr)	2.1×10^{-5}	1 in 48, 000

(1) Based on EPA load projections, transport models, and risk coefficients derived from BEIR.

(2) Based on no control of effluents. EPA proposes a seven-fold reduction.

(3) Annual total body dose of 0. 007 mrem

(4) Effective annual gonad dose of 0. 008 mrem

(5) Based on current practice containment factor of 10. EPA proposes further reductions.

(6) Annual thyroid dose of 0. 098 mrem

(7) Annual lung dose commitment of 0. 003 mrem, based on containment factor of 10^9 as expected by EPA

Table 2

Comparative Population Risks in the U. S. (1)

Sources	Risk of Death per Year	
From all causes		
Under 1 year	2.2×10^{-2}	1 in 46
1 year old	1.4×10^{-3}	1 in 735
10 years old	2.8×10^{-4}	1 in 3600
35 years old	2.1×10^{-3}	1 in 470
55 years old	1.2×10^{-2}	1 in 85
Average population	1.0×10^{-2}	1 in 100
From 170 mrem/year	5.0×10^{-5}(2)	1 in 20, 000(2)
From natural disasters	1.0×10^{-6}	1 in 1, 000, 000
From 1 mrem/year	2.9×10^{-7}(2)	1 in 3, 400, 000(2)

(1) From Comar(7)

(2) Based on BEIR(1)

Table 3

Individual Risk of Acute Fatality by Various Causes[1]

Accident Type	Approximate Individual Risk Acute Fatality Probability/yr[2]	
Motor Vehicle	3×10^{-4}	1 in 3,300
Falls	9×10^{-5}	1 in 11,000
Fires and Hot Substance	4×10^{-5}	1 in 25,000
Drowning	3×10^{-5}	1 in 33,000
Poison	2×10^{-5}	1 in 50,000
Firearms	1×10^{-5}	1 in 100,000
Machinery (1968)	1×10^{-5}	1 in 100,000
Water Transport	9×10^{-6}	1 in 110,000
Air Travel	9×10^{-6}	1 in 110,000
Falling Objects	6×10^{-6}	1 in 170,000
Electrocution	6×10^{-6}	1 in 170,000
Railway	4×10^{-6}	1 in 250,000
Lightning	5×10^{-7}	1 in 2,000,000
Tornadoes[3]	4×10^{-7}	1 in 2,500,000
Hurricanes[4]	4×10^{-7}	1 in 2,500,000
All Others	4×10^{-5}	1 in 25,000
Nuclear Accidents (100 reactors)	3×10^{-9}	1 in 330,000,000[5]

[1] From Table 6.3, WASH-1400[8]

[2] Based on total U.S. population and 1969 statistics, except as noted

[3] 1953-1971 average

[4] 1901-1972 average

[5] Based on approximately 15 million people located within 20 miles of nuclear power plants. If the entire U.S. population of about 200 million people were to be used, then the value would be 2×10^{-10}.

References

1. National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," 1972.

2. National Council on Radiation Protection and Measurements, "Basic Radiation Protection Criteria," NCRP Report 39, 1971.

3. International Commission on Radiological Protection, "Implications of Commission Recommendations that Doses be Kept as Low as Readily Achievable," ICRP Publication 22, 1973.

4. United Nations Scientific Committee on the Effects of Atomic Radiation, "Ionizing Radiation: Levels and Effects," Volumes 1 and 2, 1972.

5. National Council on Radiation Protection and Measurements, "Review of the Current State of Radiation Protection Philosophy, NCRP Report 43, 1975.

6. U.S. Environmental Protection Agency, "Draft Environmental Statement for a Proposed Rulemaking Action Concerning Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle," 1975.

7. Comar, C. L., "Presentation of the U.S.A. National Academy of Sciences Report on the Effects on Populations of Exposure to Low Levels of Ionizing Radiation, 1. General Review and Implications," Proceedings of the Third International Meeting of the International Radiation Association, CONF. 730970-P1 and 2, 1974.

8. U.S. Atomic Energy Commission, "Reactor Safety Study (Draft)," WASH-1400, 1974.

R. C. Youngdahl
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September 15, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
US Environmental Protection Agency
Washington, DC 20460

COMMENTS OF CONSUMERS POWER COMPANY ON
PROPOSED EPA STANDARDS ENTITLED "RADIATION
PROTECTION FOR NUCLEAR POWER OPERATIONS"

In response to the Agency's May 29, 1975 Federal Register notice concerning proposed radiation protection standards, Consumers Power Company wishes to make the following comments, which are in addition to comments being filed by Shaw, Pittman, Potts & Trowbridge on behalf of the utility group which includes Consumers Power Company:

1. EPA has selected only two of the conclusions of the BEIR Report to justify the need for the proposed standards. Two other conclusions of the BEIR Committee, not referenced by EPA, are also important:

   (a) "The public must be protected from radiation but not to the extent that the degree of protection provided results in the substitution of a worse hazard for the radiation avoided. Additionally there should not be attempted the reduction of small risks even further at the cost of large sums of money that spent otherwise, would clearly produce greater benefit."

   (b) "Medical radiation exposure can and should be reduced considerably by limiting its use to clinically indicated procedures utilizing efficient exposure techniques and optional operation of radiation equipment."

   The Agency in its Draft Environmental Statement and in its proposed rule has not considered radiation exposures from other sources and the cost-effectiveness of reducing these exposures. Also the Agency has not considered the effect that the proposed standards may have on encouraging the use of alternate methods of generating electrical power and the potential health effects from these alternate methods, which full consideration of the first BEIR Report conclusion quoted above would require.

2. We also question the timing of the proposed regulations. Appendix I to 10 CFR Part 50 is now in effect for nuclear power plants. There is no immediate prospect for the operation of reprocessing plants. The need at this time for additional comprehensive regulations, as proposed by EPA, is therefore questionable at best. There is time to develop a more sound basis for the proposed regulations. Also, NCRP recently issued Report No. 44, "Krypton-85 In the Atmosphere - Accumulation, Biological Significance, and Control Technology". This Report presents the detailed analysis that the EPA-DES is lacking and as such should be reviewed in detail by EPA. Report No. 44 estimates that skin dose from world production and dispersion of Kr-85 will average 2.0 mrem/yr by the year 2000, while whole body dose is estimated to be 0.02 mrem/yr by the year 2000. NCRP estimates are based on an installed world nuclear electric power capacity of 4,500 GW with fast breeder reactors accounting for 58.7 percent of the total. Further, NCRP estimates that the United States will have only 20 percent of the installed nuclear power capacity in the year 2000. Therefore, any policy adopted by EPA would only reduce projected health effects by 20 percent. NCRP concludes:

   > "The dose from Kr-85 for the next several years will be of such a low order as to preclude the need for installation of recovery systems. However, as such systems become available for full-scale application, their installation in fuel reprocessing plants should be considered in relation to the costs of such installations and the benefits, if any, that would result."

   Based on NCRP's Report No. 44, EPA's proposed deadline, 1983, for Kr-85 control cannot be justified in terms of potential health effects to the US population or the world population.

3. EPA uses exclusively the BEIR Committee's linear extrapolation of dose and effect. This adaption of the linear hypothesis requires the extrapolation of empirical linear dose-effect curves by a factor greater than 1000 in dose and by factors from 100 million to one billion in dose rate. There are several other authoritative reports dealing with assessment of the biological effects of radiation which should have been utilized. Two of these reports are the United Nations 1972 UNSCEAR Report and NCRP Report No. 43. In Report No. 43 NCRP undertook the task of reviewing both the BEIR and UNSCEAR Reports "for the purpose of identifying difference, their significance, and especially how they relate to the NCRP's recommendations relative to permissible exposures or dose limits for the public".

   On linear extrapolation NCRP states:

   > "that risk estimates for radiogenic cancers at low doses and low dose rates derived on the basis of linear (proportional) extrapolation from the rising portions of the dose-incidence curves at high doses

> and high dose rates . . . cannot be expected to provide realistic estimates of the actual risks from low level, low-LET radiations, and have such a high probability of over-estimating the actual risk as to be of only marginal value, if any, for purposes of realistic risk-benefit evaluation".

Report No. 43 continues:

> "The NCRP wishes to caution governmental policy-making agencies of the unreasonableness of interpreting or assuming upper limit estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption. The NCRP has always endeavored to insure public awareness of the hazards of ionizing radiation, but it has been equally determined to insure that such hazards are not greatly overestimated. Undue concern, as well as carelessness with regard to radiation hazards is considered detrimental to the public interest."

Apparently NCRP's caution was not heeded by EPA, as illustrated in the Wall Street Journal's report on the proposed standards:

> "The stricter standards would prevent 1000 cases of cancer or serious genetic damage during the next 25 years, Mr. Train said."

Table 10, page 82, of the EPA Draft Environmental Statement is misleading in several aspects. First, while it is clear that the health effects are attributable to releases from the U.S. nuclear industry, EPA does not clearly point out that the projected health effects from long-lived materials, used to justify the proposed rules, are global and not restricted to the U.S. population. In regard to shorter-lived materials, commercial reactors do not nor have they ever approached the permissible dose levels of the Federal Radiation Guides. Therefore the suggestion of an actual reduction of about 34,000 potential health effects attributed to Appendix I is extremely misleading.

The presentation of health impact in terms of absolute population risks, that is the summation of annual doses to individuals over large populations and long time spans, is a dramatic way of impressing the general public. But it obscures the fact that the postulated risks, relative to others accepted by the population, are quite small.

It is suggested that EPA reevaluate its use of the linear, no-threshold hypothesis and irrespective of its future acceptance or rejection of the hypothesis compare the risks due to effluents from the U.S. nuclear industry and risks due to other industrial pollutants.

4. The proposed rules refer to both "proposed Appendix I to 10CFR50" and "Appendix I to 10CFR50". Since Appendix I as finally adopted differs significantly from the earlier proposed versions it is not clear which version the EPA considers satisfactory for implementation of the proposed environmental radiation standards. If the Agency does endorse Appendix I as adopted, it would be appropriate to incorporate in Part 190 a statement that compliance with Appendix I to 10CFR50 provides satisfactory implementation of the Part 190 regulation insofar as light water power reactors are concerned.

5. The proposed standard imposing a 25 mrem per year per site limit poses an unnecessary obstacle to the nuclear energy park concept. The Appendix I limit is 8 mrem per year per reactor. The proposed EPA standards would effectively limit the number of reactors per site to three. The Draft Environmental Statement contained tables estimating doses from power plants. These estimates were in the range of 1 to 2 mrem, allowing EPA to assume that the 25 mrem standard is practical for a number of reactors at a site. Appendix I limits are based on extensive hearings and as such provide a more realistic limit of what can be achieved by industry.

6. Two extremely important issues not considered by EPA are the implementation of the proposed standards and the allocation of the curie limits among the various fuel cycle facilities. EPA has made it clear that these two items fall under the jurisdiction of the NRC. Therefore, until the NRC has formulated its implementation and allocation plans it is impossible for industry and the EPA to accurately assess the total impact of the proposed standards.

7. Cost estimates for implementation of the proposed standards are given by EPA as less than $100,000 per potential health effect averted (less than $75 per person rem). Consumers Power does not believe EPA's cost estimate is correct. Figures 3 and 4 of the DES depict the cost effectiveness of the control measures examined by EPA. These figures suffer from several deficiencies, including: (a) the lack of detailed backup for Figures 3 and 4; (b) the lumping together of a number of treatments in the case of liquid radwaste systems; (c) assigning the "no control" case a cost of zero when actually several million dollars have already been spent; (d) not indicating on either Figure the break point between cost effectiveness and cost ineffectiveness; and (e) not indicating that nearly all "cost-effective systems" are standard industry practice.

We appreciate the opportunity to comment, and trust that the proposed standards will be scrutinized in depth in meaningful public hearings.

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October 3, 1975

Director, Criteria and Standards
Division (AW-560)
Office of Radiation Programs
United States Environmental
Protection Agency
Washington, D.C. 20460

SUBJECT: Comments on EPA Proposed Standards "Radiation Protection for Nuclear Power Operations"

Dear Sir:

Enclosed are our comments on the EPA proposed standards "Radiation Protection for Nuclear Power Operations" which we respectfully submit for your consideration.

You will note that we are transmitting these comments under my signature as Supervisor of the Radiation Management Group. The comments represent a consensus of the thinking of my colleagues in the radiation management area. However, it should be noted that Bechtel Power Corporation is more concerned with the plant design required to achieve specific radiation protection limits than with the formulation of such limits. As such, my company believes that establishing radiation protection limits is outside its area of expertise and, therefore, the comments do not necessarily represent the position of the Bechtel Power Corporation.

We trust that these comments will be useful in your development of proper radiation protection standards.

Very truly yours,

Jene N. Vance
Supervisor, Radiation Management

JNV/aw
Attach.

Comments
on EPA Proposed Standards, "Radiation
Protection for Nuclear Power Operations"

I. Relationship to ALAP

We applaud the EPA's effort to develop comprehensive standards to protect the public health and safety from radiation in the environment from the uranium fuel cycle. However, the arguments for promulgating these standards are not overwhelmingly convincing without knowing the fate of the ALAP requirement as established in 10CFR20. If those portions of Part 20 which pertain to releases to unrestricted areas (including the ALAP requirement) are to be replaced with the EPA standards then there is indeed a compelling argument for the standards as proposed. We assume that Part 20 will be modified once the EPA standards are issued to eliminate the conflict between the two federal regulations. The effect then of the EPA rulemaking hearing and standards would be to establish radiation limits for the entire fuel cycle which are considered ALAP and should, therefore, eliminate any future rulemaking hearings to determine ALAP in the fuel cycle. If, on the other hand, the EPA standards are not intended to determine ALAP radiation limits then the usefulness of the proposed standards is questionable because the value determined in an ALAP proceeding would become, in effect, a limit by way of its implementation and enforcement.

II. Implementation

This raises three questions on the implementation of the proposed standards. First it is stated that with minor modifications Appendix I could be issued to implement these standards. We do not see how Appendix I could be used to implement the EPA standards. The EPA standards as proposed contain no directives or requirements regarding ALAP which Appendix I allegedly quantifies. In addition it appears that even though the EPA and AEC have determined "limits" which each considered as low as reasonably achievable, each concluded that a different value was appropriate. This isn't too surprising as each derived the values using fundamentally different cost-benefit approaches and dose models for their determinations. After reviewing both, we believe that the approach used by the EPA has greater merit in that the entire fuel cycle was considered and environmental impacts for the long-lived isotopes were included. We believe that with further refinements (as discussed later) in the source term, dose models and cost analysis the EPA standards could be implemented as the ALAP values.

The second question on implementation concerns the source terms and dose models to be used in predicting the environmental doses in the design phase of the various fuel cycle facilities. Throughout the Appendix I rulemaking hearing it was obvious that the source terms and dose models were no less important than the dose limits themselves and in fact they must be as realistic as possible to validate the "as low as reasonably achievable" requirement. We strongly urge that the EPA provide clear direction to the NRC on the dose models and the nuclide environmental transport properties to be used in determining the environmental doses. Also the NRC should be advised to develop realistic source terms incuding pertinent chemical and physical properties that are used in the dose assessments.

The third question is one of apportionment. The Agency does not provide clear direction to the NRC on the method of apportioning an individual's dose between the facilities in the fuel cycle. It would seem that the apportionment of the doses should bear some relationship to the cost-benefit analysis performed to establish the standards. This guidance should be provided to the NRC.

III. Approach to Setting Standards

In the draft Environmental Statement the EPA described a methodology by which they examined population impacts to establish the proposed limits. After reviewing this methodology we have some serious questions regarding the impact on populations and the perspective that was adopted to weigh this impact. In the following discussion we would like to present a rationale for setting the standard based first on individual impacts and second on population impacts. We will argue that the individual impact is an increase in mortality risk and that the limit should be established at a level at which the increase in risk is "acceptable." The judgement on the acceptability of the increase in risk should be based on a comparison of risks from other societal activities which apparently have been found to be acceptable to the public. We will argue that the population impact can be examined by either determining the cost of a mortality and comparing this cost to the cost of avoiding the mortality or by doing a comparison of the cost-effectiveness of reducing mortalities in this industry with other industries or societal activities. In this manner it can be determined if the limits established for protection of the individual should be further reduced in the name of ALAP.

What Constitutes an Impact?

Before we discuss a methodology which could be used to establish an acceptability level, it is important to identify with some definitiveness what constitutes an impact on individuals, both directly and in a collective sense. It should be realized that impacts can only be experienced by individuals either directly or by individuals when considered collectively. Even though all impacts are experienced only by individuals, those impacts which are direct are termed individual and those which are considered collectively are termed population impacts. We'll use these terms to distinguish between the two types of impacts. The distinction between the two is important since the population impact is not "equivalent" to the individual impact and, therefore, the standard-setting process should focus on the proper weighting of the impacts.

An impact on an individual or population as a result of any societal activity is ultimately a reduction in their potential capability to achieve the goals that they deem appropriate. Any society activity may have side effects such as deaths, disease, disability, mental and physical degeneration, etc. which are clearly seen to be impacts as they, in varying degrees, reduce the potential capability of individuals and populations to achieve their goals. The degree to which the side effects reduce each capability must be examined to establish an acceptable level of protection.

For individual impacts it seems fairly self-evident that any of the above mentioned side effects result in a direct reduction in the potential capability of an individual to achieve his goals. The magnitude of the reduction, of course, varies with the side effect from an ultimate reduction caused by death to a slight reduction caused by a small disability. If the side effects are known for a given society activity then judgements can be made on the relative severity of the reduction (e.g. aversion factors). For populations, it is not evident how the above side effects result in a reduction in the potential capability of the population to achieve their goals without first considering the factors which affect the population's goal achievement capability. The following represent the obvious, and probably the most important, factors which may limit a population from achieving a given goal:

a. replacement and expansion capability of the population
b. intelligence resources
c. manual skills resources

d. moral resources
e. natural resources and capital (in excess of that required for fundmental life support).

With the exception of factors a. and e. it does not appear to be possible to express these factors in any quantifiable terms and, therefore, the magnitude of the reduction in these factors from a given side effect cannot be determined. Nevertheless, it appears that qualitative judgements can be and must be made if population impacts are to be addressed in any context other than in a comparative exercise with other industries.

Individual Impact

We have started with the premise that a govenmental agency acting on behalf of the people it represents should regulate the activities of the society for the adequate protection of all the individuals in the society. An agency, acting with the will of the people, should establish the levels of protection for the public at a point where the impact on individuals is acceptably low. The determination of an acceptably low level is, of course, the crux of any regulatory process.

It is assumed that the side effects from the nuclear power industry are radiation induced health effects (primarily cancer and genetic diseases). At the levels of radiation of concern for the proposed standards, the individual impact, for both current and future generations, is an increase in the risk of experiencing some health effect. It is interesting to note that even though it is likely that the individual impact could end up being the basis for establishing standards, there were no individual risks presented in the DES and, accordingly, we believe this is a serious deficiency in the DES. The risks should be presented as potential mortality risks per person per unit time based on the appropriate age-specific risk coefficients. The risks to future individuals from genetic effects should be presented as a function dose to members of the reproductive population. If effects other than death are to be included in the risks then some adjustment factor should be included to account for the difference between fatal and non-fatal effects.

Plots should then be developed of dose to a site boundary individual as a function of cost for the radiation control features for each typical facility in the fuel cycle. Where an individual may receive a dose from more than one facility (i.e. two reactors on a site or one reactor and fuel processing plant, etc.) radiation control features to be added to the facilities should be determined by treating them as a single facility. The radiation control features should be added to the facility(ies) in order of decreasing cost-effectiveness. The source term used to calculate the facility site boundary individual doses at the various dose levels should be used to calculate the population exposures-for the projected growth of the nuclear industry. The population exposures would be used in the exercise aimed at determining the population impact. The exposure rate (or annual dose) based on the long-term buildup of the long-lived isotopes should be estimated to determine the individual somatic risks for future generations.

Based on the fundamental premise that all individuals are to be protected, the individual at maximum risk (genetic or somatic) should be the focus for the acceptability judgements. It appears that the risk that an individual is willing to accept when he participates in an activity depends on the value of the activity to him. We believe it is not presently possible to quantify the benefits of power generation and compare them to the benefits of other societal activities and the risks which they entail. However, we believe that from observations of activities (both voluntary and involuntary) in which a large fraction of the population engage, judgements can be

made regarding the range of acceptable risks. The choice of activities which are widespread in the population has the effect of ensuring that the risk aversion characteristics demonstrated are typical of the population and that the benefits (although unknown) from the various activities are probably relatively high and to some degree comparable. The individual risk for the maximum exposed individual could then be compared to the risks from other societal activities which apparently have been found to be acceptable to the public.

The judgement on the acceptable individual risks for future generations who do not directly receive the benefits of power generation is somewhat difficult. However, it is likely that for future generations the first generation progeny of the site boundary individuals will be at the highest risk. It may be argued that in part the progeny will benefit directly from the power generation and presumably the progeny is expected to exhibit risk aversion characteristics similar to the parents. For generations beyond the first generation it is likely that the risks from genetic effects and long-lived isotopes will be significantly lower than the risks which current generations routinely accept and should not be an onerous burden even though they are not the direct recipients of the benefits.

Population Impact

After the individual impact has been examined at the proposed limit then the population impact should be evaluated to determine if the limit should be further reduced for ALAP purposes. The factors a. through e. discussed previously which serve as a measure of the impact on a population should be examined. In the DES we could not find a qualitative expression of the impact on the population. Throughout the DES there are statements that without the proposed standards the health effects "would be large" (page 13) or "substantial" (page 14), etc. Yet there are not criteria provided on which this judgement is based nor is there a comparison provided which indicates clearly what the impact is in relation to anything. We believe that an examination of the factors a. through d. and the number of effects at the level of concern for standards will lead to the conclusion that the population impact is probably insignificant. Factor e., which is the economic cost consideration, remains and should be evaluated. In effect this says that the standard first considered the risks from an individual point of view and now the economics, when considered collectively, should be accounted for. This approach is, generally, that approach used by the Agency in the DES, namely a comparison of the dollars spent today to reduce health effects which could give rise to a potential expenditure in the future.

In our opinion, however, the discussion of the derivation of the value or worth of a health effect in the DES is seriously deficient. Reference is made in the DES to authors in the literature who derived values based on, in one case, the loss of earning capacity for an individual and in another case on the total annual U.S. health care budget. We believe that these values should be carefully examined and that a rational *method should be developed which more* closely relates the societal cost with each potential effect being predicted. The value should include an estimate of the actual health cost associated with a specific effect and the life support costs for the individual and dependents during periods of disability or death. The life support costs should be determined realistically for the period of time in which real costs are actually incurred for life support. This should be done according to age and functional role in society. For example an individual 65 years old is likely to incur only health care costs as the life support costs could be assumed to be taken care of by Social Security. An example of the functional role is a married person whose life support costs are already being borne by the other marriage partner. The society costs associated with the loss

of a consumer in the consumer-producer cycle or a taxpayer in the taxpayer-government expenditure cycle during an adjustment to new cycles should be considered to determine if it is a significant cost. We are not certain how costs incurred in the future should be treated economically. It is obvious that the effects which would occur well into the future will have exceedingly small present worth factors associated with the costs.

As an alternative to the above cost evaluation (or perhaps in combination) a comparison should be performed of the cost-effectiveness of reducing mortalities resulting from other industrial or societal activities. Limited studies could be performed to estimate the costs associated with methods to reduce or prevent mortalities resulting from other societal activities, such as health care, building construction, transportation, etc. In the absence of quantifiable benefits from power generation we believe that this comparison would provide a basis against which the costs to reduce radiation in the environment to ALAP levels could be judged to be practicable.

IV. Dose Assessment Period

We fully support the EPA's decision to limit the dose assessment period to a period of time for which future uncertainties do not make the predictions wholly unsuitable. For long-range predictions there are major uncertainties; in population growth and demographic patterns, in the environmental removal factors, in medical advances for the successful treatment of cancer, in future economics and even in the radiosensitivity of humans. These uncertainties argue strongly for a limited dose assessment period in the range of 100 years as selected by the EPA. Additionally, these uncertainties coupled with: (1) an ever-declining exposure rate, (2) an extremely low incremental risk and (3) indirect benefits passed on to future generations tend to answer the problem of future generations being exposed to risks for which they receive no direct benefits.

V. Source Terms and Dose Models

Since the proposed standard requires that doses to individuals not exceed 25 mrem per year and since this value is at the levels which can be practically measured, the validity of the dose and source term models used to establish the standard and determine compliance are obviously of key importance. Use of overly conservative models is not acceptable since it adversely affects the cost-benefit analysis used to establish the standard.

Review of the EPA dose models and comparison of these models with the NRC models used in the rulemaking hearings for the proposed Appendix I to 10CFR50 showed significant differences and the use of many basic assumptions without substantial documentation or apparent physical basis. We agree that better data may not be available today and that additional environmental studies may be required. However, it is important that these differences be resolved and that as realistic as possible models be developed prior to completing the rulemaking process if the standards are to be accepted as valid limits for the nuclear power cycle.

VI. Direct Radiation

In the DES we could not find where the exposures from direct radiation had been accounted for in the health effects nor in the cost-benefit analysis. The cost-benefit analysis used

to develop the whole body exposure limit was based upon the EPA report "Environmental Analysis of the Uranium Fuel Cycle." That report does not address direct radiation exposure reduction. Because of the significant dissimilarities between the direct radiation and effluent exposure pathways and in particular in the cost-effectiveness of reducing the environmental impacts, it is important that the direct radiation exposure pathway be explicitly accounted for in the analyses. If, on the basis of a cost analysis including direct radiation, it appears impractical or unreasonable to establish a single limit to control both effluents and direct radiation, then consideration should be given to establishing a separate limit within the standards for the direct component.

VII. Dose Risk Conversion Factors

Dose-risk conversion factors were used in the EPA's Environmental Analysis of the Uranium Fuel Cycle to evaluate the number of health effects in the population from radiation. The environmental analysis stated that the dose-risk conversion factors were derived from ICRP No. 8 and the BEIR and UNSCEAR Reports. Many conclusions drawn in the DES were derived directly from the environmental analyses of the health effects caused by radiation using these dose-risk conversion factors. These comments pertain to these conversion factors.

a. The EPA proposed a whole body limit of 25 mrem per year based on a risk-benefit analysis and a cancer morbidity dose-risk conversion factor of 700 cases of adverse health effects per million man-rem. The EPA stated that the corresponding average risk of thyroid cancer is 56 cases per million man-rem, yet the EPA proposed a thyroid dose limit of 75 mrem per year. If a risk-benefit analysis is applied to the thyroid dose limit, which should be valid since this approach is used to establish the whole body limit, the resulting thyroid limit would be approximately 12 times higher than the whole body limit or 300 mrem per year. The use of either a higher or lower limit than justified by the cost-benefit analysis is not consistent with the premise that a cost-benefit analysis is the appropriate methodology in setting a detailed justification for the use of the lower limit of 75 mrem per year.

b. Of the 700 adverse health effects considered for whole body doses, approximately 100 or more result in mortality. According to the BEIR report, thyroid cancer rarely results in death. The EPA standards for thyroid doses does not reflect this difference in severity or consequence from the applicable adverse health effect. We recommend that the EPA consider this point when finalizing the standards.

c. Consistent dose-risk conversion factors were not used throughout the report. For example, Part II which concerns power reactors, used a thyroid cancer risk of 60 cases per million man-rem for persons over 20 whereas Part III concerning fuel reprocessing used a risk of 5 cases per million man-rem.

VIII. Miscellaneous Comments

1. Although we agree with the use of a linear dose-effect, rate-independent relationship, we believe that the health hazards or effects resulting from radiation exposure should properly be qualified as "potential." As stated in the DES the actual relationship is "beyond scientific resolution" and, therefore, the BEIR report provides the best estimate available of the potential effects of radiation exposure. One loses this perspective of potentiality in reading the DES and Environmental Analyses.

2. Figure 3 on page 37 of the DES presents curves of risk reduction as a function of cost incurred in the uranium fuel cycle. We could not determine from the curve the level of health effects associated with the proposed standards. This would be very helpful in gaining perspective on the expected impact using the EPA standards. As a corollary to this we are not clear on how this figure was used to derive the limits contained in the standards. Also it should be noted that although the figure is titled "Risk Reduction . . ." we do not believe that the values shown are risk values in the sense of a potential hazard to a person over a given unit of time.

3. We believe that greater perspective needs to be provided in the DES by comparing the number of potential health effects resulting from the nuclear industry to the number of total health effects which are occurring over the same time period from all other causes.

Wisconsin Electric POWER COMPANY
231 WEST MICHIGAN, MILWAUKEE, WISCONSIN 53201

March 4, 1976

Mr. William D. Rowe
Deputy Assistant Administrator
Criteria and Standards Division
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Rowe:

PROPOSED STANDARDS 40 CFR 190

References:

(1) EPA, Environmental Radiation Protection for Nuclear Power Operations, Proposed Standards (40 CFR 190), Supplementary Information, January 5, 1976.

(2) EPA, Office of Radiation Programs, Draft Environmental Statement for a Proposed Rulemaking Action concerning Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, May, 1975.

(3) Thomas F. Mancuso, M.D., and Barkev S. Sanders, Ph.D., "Study of the Lifetime Health and Mortality Experience of Employees of AEC Contractors", Progress Report #10, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA, COO-3428-5, April 30, 1974. Also Report #11, dated 1975.

We have reviewed the proposed EPA regulations (40 CFR 190) and associated documentation as presented in References (1) and (2) above. Certain of our technical and administrative concerns are addressed in the Utility Group comments; however, we wish to point out to you certain studies of radiation effects in response to your implicit request for additional contrary data in Supplement B to Reference (1).

We refer the EPA to the Mancuso-Sanders study (Reference (3), above). Over a decade ago, Drs. Mancuso and Sanders began assembling records on employees from Hanford, Oak Ridge, and other nuclear installations. The follow-up period for the statistical study populations goes back to 1943. The analyses through Report #10 have been limited to Hanford employees, siblings of these employees, job applicants who were examined and offered a job but who declined the offer, and siblings of the latter "nonstarts". Over 55,000 people have been included in the study. Mortality has been the only criterion of health examined as of Report #10.

During the first nine years of the study, no statistically significant correlations were demonstrated. The authors stated that there is no evidence that those with a higher dose level are more likely to die in a given year in comparison to those with a lower dose. On the contrary, in Report #10 the authors demonstrated "a statistically significant higher longevity for radiation-exposed employees as compared with employees with no known record of exposure to whole body external penetrating radiation". Certain conclusions of this study are expanded in Report #11.

In addition to the striking conclusions of the Mancuso-Sanders study, there seems to be a large data base available for further study. For example, we call your attention to Appendix C to the Mancuso-Sanders Report #10. In this appendix, Dr. Sanders notes exposures for a certain Hanford subgroup within the study population: 54,840,054 mrem recorded for 16,689 males and 2,755,200 mrem recorded for 3,444 females, a total of 5.76×10^7 person-mrem! This number approaches the dose commitments associated with Kr-85 releases in Table 3 of Supplement F of Reference (1). In this table, the EPA appears to assume 2.5×10^6 mrem per whole body health effect. If we apply this number to the Mancuso-Sanders stucy subgroup, about 23 health effects should have been observed. Without a complete statistical analysis, we do not know whether these health effects could be observed with any degree of certainty in the Mancuso-Sanders population. However, it is important to note that the entire Mancuso-Sanders data base probably does have an even greater total of person-mrem allowing such further conclusions to be reached.

In view of the multi-million dollar costs to both industry and society for the vanishingly small radiation limits both proposed and in effect, it is imperative that EPA explore available data bases (such as that of Mancuso-Sanders) to either reaffirm or deny the degree of conservatism required in radiation control.

Other areas are equally attractive for study. One such possible source are the populations of mountain cities and other high natural background areas, although the difficulty of establishing reliable control populations is acknowledged. We note, however, an even more easily accessible source of data. From Table 4 of Supplement F of Reference (1), we conclude that EPA uses a value of approximately 1.7×10^7 mrem per health effect for thyroid irradiation. Since thyroid uptake studies with radioiodine result in a thyroid dose on the order of 200 Rem or 2 x 10^5 mrem, one would expect that, on the average, about one out of every 85 patients undergoing this thyroid diagnostic procedure should exhibit an undesirable health effect if the EPA number is correct. While we doubt that an undesirable effect on 1/85 of all thyroid uptakes would go unnoticed, this area should be investigated to either confirm or disprove the EPA assumption. The starting point for such a study is reasonably accessible, i.e., hospital medical records.

Supplement B to Reference (1) decries the lack of non-linear models proposed by critics. For such a model based solely on human data, we refer you to the studies of Dr. Rowland at Argonne National Laboratory. Dr. Rowland has been studying radiation effects on those with rather large burdens of radium, principally those who had been radium dial painters. Certain of Dr. Rowland's models fit a dose-squared function.

In Supplement B to Reference (1), it is stated that, "the Agency's use of a linear nonthreshold model to estimate genetic risks . . . was not questioned". We feel that the statement should have more accurately read, " . . . was not commented upon." Obviously far more research has been done on somatic effects, making it the most fertile area on which to base comments. On the other hand, far less work has been invested in genetic effects, although sufficient evidence exists to support reversible chemical damage, biological repair, and other theories which enable one to question the applicability of the linear nonthreshold model even to genetic effects. The Agency should not assume tacit approval by the scientific community based merely on a lack of comments.

Finally, we were surprised to read the following paragraph quoted from the last few pages of Supplement B of Reference (1):

> "Some commentors expressed the view that numerical estimates of radiation-related risks are of little use if they are not compared with the risk from other environmental pollutants. While the Agency accepts that such comparisons, including a comparison with natural background radiation, may place the radiation risk from man's activities in a perspective useful to the public, the Agency does not accept such comparisons as the primary basis for establishing radiation protection standards, since at least it could only result in equity between pollutants - not between costs and benefits. Having made an assessment of potential health risks the Agency believes it is more appropriate to select appropriate limits by means of a cost-effectiveness of health risk reduction methodology, rather than via comparative risk assessment".

Taken at face value, this paragraph would seem to be an admission that selection of general areas for regulation and control is based on Agency whim rather than on objective analysis. Undoubtedly the writer of the quoted paragraph did not intend this direct interpretation of his argument; however, certain conclusions are inescapable. Overall Agency function must consider relative risks in order to rationally ensure environmental quality. For example, if the average individual is subjected to a risk of 10^{-4} health effects per year from one pollutant, it makes little sense for the Agency to put forth a substantial effort to reduce another pollutant which subjects the average individual to a risk of only 10^{-8} health effects per year. We are not saying that risks from all pollutants should be equal, but we are saying that control and regulation of minor risks must proceed in proportion to their contribution to overall risk. The individual exposed to an overall risk of 0.004002 is willing to pay far more to change the "4" than he is to change the "2". Hence, cost-benefit must be done on both an interpollutant and intrapollutant basis; and relative risk must be factored into the interpollutant analysis.

We would appreciate your consideration of our comments, and we look forward to some resolution of the difficulties addressed.

Very truly yours,

Sol Burstein

Sol Burstein
Executive Vice President

S-1

State of Maine
Executive Department
Augusta, Maine
04333

JAMES B. LONGLEY
GOVERNOR

June 25, 1975

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs
U. S. Environmental Protection Agency
Washington, D. C. 20460

Subject: Proposed Regulations for Environmental Radiation Protection Standards for Normal Operations of Activities in the Uranium Fuel Cycle

Dear Dr. Rowe:

In response to your recent letter, asking for the State of Maine's response to proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, please be advised that I referred your environmental statement along with your proposed environmental standards to the Division of Health Engineering in the Department of Health and Welfare for review and comment.

Division of Health Engineering's staff approves of the lower annual whole body dose guides since many of the existing nuclear power facilities have demonstrated their abilities to more than adequately meet the proposed limits.

The Division was also pleased to see limits put on the total quantity of Krypton-85 and Iodine-129 discharged to the general environment.

Thank you for allowing us the opportunity to review the proposed regulations.

Sincerely,

Jim Longley
JAMES B. LONGLEY
Governor

JBL/ged
84

S-2

STATE OF MARYLAND
ENERGY POLICY OFFICE
5TH REGIMENT ARMORY 219 WEST HOFFMAN STREET BALTIMORE, MARYLAND 21201
383-6810

MARVIN MANDEL
Governor

John P. Hewitt
Director

June 27, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

We have reviewed your "Environmental Radiation Protection Standards for Nuclear Power Operations" along with the supporting Draft Environmental Statement, and have several comments:

1. The difficulty of enforcement of the proposed standards is underestimated. While this buck is passed to the Nuclear Regulatory Commission, the type of standards proposed by the EPA will make enforcement extremely difficult in the case of fuel cycle operations in close proximity to each other, or for the transportation of nuclear materials. If the trend continues to develop nuclear complexes (possibly co-locating up to 40 nuclear reactors, as has been suggested), regulation might be impossible, using the proposed approach. The answer may be to address that problem as the need arises, but such an approach (similar to the manner in which air quality standards have been promulgated) is inadequate because it does not provide the industry a sound framework by which they can plan future operations.

2. In areas where the EPA professed insufficient information to propose standards (e.g., for the release of tritium or carbon 14), the attitude is to wait and see. Careful consideration is promised in the event information becomes available. It should be a foremost charge of the EPA to insure that such information is developed as soon as possible. Furthermore, it is interesting to note that a provision for variance is provided in order to exceed standards, but no provision is made for inclusion of stricter standards, or to regulate radioactive materials not included in the proposed standards.

3. The matter of variances raises serious questions. All the best judgements which were made to establish the initial standards can evaporate overnight if variances are given freely in the name of "public welfare."

Under the pressure for energy supply sure to develop in the years ahead, variances could become the rule rather than the exception. Moreover, such variances would not be subject to the careful balancing with which these initial standards were developed. At the very least, the circumstances under which variances will be issued should be laid out in detail. "Temporary and unusual operating conditions" requiring variances should be precisely defined, and the tradeoffs examined closely.

In general, we feel the risk-benefit approach to be a valid and superior methodology for balancing public interests. Care should be taken in developing societally reasonable standards for all radiological threats; these standards should not be allowed to erode by hastily contrived variances.

Sincerely,

John P. Hewitt
Director

JPH:a

SOUTH Dakota Department of
Environmental Protection
Pierre, South Dakota 57501
Phone (605) 224-3351

July 1, 1975

W. D. Rowe
Deputy Assistant Administrator
for Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Dr. Rowe:

I am writing in response to your letter of June 3, 1975, to Governor Richard F. Kneip of South Dakota, concerning the draft environmental statement regarding proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle. The State of South Dakota has statutory authority to control the distribution of toxic and radioactive wastes into the State's waterways. The purpose of the State's water quality standards is to protect the health and safety of the public. The South Dakota Department of Environmental Protection intends to achieve this goal by assuring that water quality standards should not be violated by the introduction of radioactive effluent into the environment at levels considered to be dangerous to any form of plant or animal life.

No plans for construction of nuclear power generating plants in South Dakota at any future data have been presented. Considering the proximity of future coal deposits, coal-fired electric generating plants may be constructed if economically feasible. In fact, interest has been expressed by various power companies in construction of coal-fired plants in the near future.

The draft environmental statement appears to present adequate information and sets forth valuable guidelines in dealing with the environmental impact of nuclear power generating plants. Should these plants at some future point in time be constructed in South Dakota, the statement would be valuable in setting local standards for maintaining safe levels for radioactive effluent.

Sincerely,

Allyn O. Lockner, Secretary
Department of Environmental Protection

cc: Richard F. Kneip, Governor
State of South Dakota

C2/04

Equal Opportunity Employer

S-4

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SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

E. KENNETH AYCOCK, M.D., M.P.H., COMMISSIONER
J. MARION SIMS BUILDING — 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

July 8, 1975

Director, Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, DC 20460

Re: Draft Environmental Statement, "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle"

Dear Sir:

The Department of Health and Environmental Control of the State of South Carolina is pleased to endorse the proposed regulations set forth and discussed in the above referenced draft environmental Statement. The review of the referenced document by staff members of our Division of Radiological Health resulted in no adverse criticisms or recommendations to improve the proposed rules. This state is especially pleased to see the Environmental Protection Agency support the installation of Kr-85 and I-129 removal equipment. We believe that the time delay afforded also provides a reasonable time within which the technologies required can be refined, and at the same time does not jeopardize the health and safety of our citizens. It is our desire that your agency further the policy adopted by supporting its adoption however possible by other nations entering into the "tail end" of the nuclear fuel cycle. We additionally encourage the promulgation of H-3 and C-14 control requirements when the technology becomes both available and feasible.

We appreciate the opportunity to comment upon the draft environmental impact statement.

Very truly yours,

Heyward G. Shealy

Heyward G. Shealy, Director
Division of Radiological Health

SB:bo

cc: Mr. H. Richard Payne, Region IV, EPA

S-5

State of Kansas . . . ROBERT F. BENNETT, Governor
DEPARTMENT OF HEALTH AND ENVIRONMENT
DWIGHT F. METZLER, Secretary
Topeka, Kansas 66620

11 July 1975

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs
U. S. Environmental Protection Agency
Washington, D.C. 20460

Dear Doctor Rowe:

Governor Robert F. Bennett has requested that we comment on the draft environmental statement regarding proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle.

The comments provided are of a general nature since Kansas does not have, at this time, any of the facilities which constitute the uranium fuel cycle.

1. The quote on page 13 from the BEIR report could benefit by a more detailed explanation so that its relative value could be more clearly understood. As it now stands, it seems possible to draw the conclusion that the Federal Radiation Protection Guides (FRPG) were intended to establish a limit for exposure to the total population of the United States from activities of the uranium fuel cycle. Although the paragraphs following the quote do point out that the components of the fuel cycle do not now approach this limit, it is not really clear that the limit was intended to include a number of possible contributors.

2. Some indication of the total quantity of power (gigawatt years) now being produced in this country by both conventional and nuclear power and the anticipated quantity to be produced in the next 100 years would also help develop some relative value points.

3. Page 8, last line, page 9, first line "The nuclear power industry is projected to grow from its present proportion of approximately four percent of total electric power capacity to over sixty percent by the year 2000 (an absolute growth of about 20 gigawatts to 1200 gigawatts)."

This is not a very clear statement. Does it mean that from 1975 to 2000 only 20 gigawatts of capacity is to be added and that addition will bring the entire installed capacity to 1200 gigawatts or is it intended to mean the growth from 1975 to 2000 will be from a present capacity of 20 gigawatts to a capacity of 1200 gigawatts in 2000.

It is hoped these general comments will be useful in your deliberations and that if we can be of further assistance, you will not hesitate to contact us.

Sincerely yours,

Melville W. Gray

Melville W. Gray, P.E.
Director
Division of Environment

MWG:ht

THE SECRETARY FOR HUMAN RESOURCES
COMMONWEALTH OF KENTUCKY
FRANKFORT 40601

July 9, 1975

W. D. Rowe, Ph.D.
Deputy Assistand Administrator
for Radiation Programs (AW-558)
U. S. Environmental Protection Agency
Washington, D. C. 20460

Dear Doctor Rowe:

Governor Carroll has asked that I respond to the draft environmental statement regarding the Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle as enclosed with your letter of June 3, 1975.

We concur with the basic philosophy that the present radiation standards should be changed to consider the potential build-up of long lived radionuclides in the environment from specific systems such as the uranium fuel cycle. We believe that the proposed standard is adequate in this regard for the radionuclides specified. In regard to the lower radiation limits for the exposure of any member of the public, this standard appears to be adequate. We are under the impression that this standard relates specifically to the uranium fuel cycle since industry can apparently meet the standard with present technology.

We note that the standard sets an effective date for the limits on Krypton-85 and Iodine-129 as January 1, 1983. This provides several years for the industry to prepare for meeting the Krypton-85 and Iodine-129 standards. It would appear appropriate that the standard should address Tritium and Carbon-14 in a similar manner. It is realized that the technology may not be as advanced for controlling these radionuclides and that an even later date for implementation of a Tritium and Carbon-14 standard may be necessary. However, without a proposed standard for Tritium and Carbon-14 it would appear there is no incentive for the industry to begin developing the technology to control the release of these two nuclides.

We do not concur with the statement made on page 6 which states "...the implications of the controls required by this rulemaking for radioactive wastes and for decommissioning represent minor perturbations on existing requirements for waste management for the fuel cycle." Any standard which further limits the release of radionuclides from the uranium cycle ultimately increases the waste inventory. In light of this apparent impact on radioactive waste disposal sites, it would appear that the EPA should consider a standard specifying the manner in which the radioactive waste should be packaged to assure no potential release into the environment from the ultimate disposal.

We do not concur with your statement on page 118 "...there are no planned releases from existing radioactive waste disposal sites..." The radioactive waste disposal facility in Kentucky is licensed for the planned release of radioactive materials through the use of an evaporator for volume reduction of onsite generated contaminated waters.

We appreciate the opportunity to review and comment on the draft environmental statement.

Sincerely,

C Leslie Dawson

C. Leslie Dawson

S-7

RAUL H. CASTRO
GOVERNOR

OFFICE OF THE GOVERNOR
STATE HOUSE
PHOENIX, ARIZONA 85007

IN REPLY
REFER TO:

July 15, 1975

William D. Rowe, Ph. D., Deputy Assistant
Administrator for Radiation Programs
Environmental Protection Agency
Office of Radiation Programs (AW-558)
Room 611, Waterside Mall East
401 M. Street, S.W.
Washington, D.C. 20460

Dear Dr. Rowe:

With reference to your correspondence, dated June 3, 1975, and the attached copy of proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, please be advised we have reviewed the document and find no significant objections.

However, we do note there might be some difficulty or confusion in applying a component of the numerical standard to any one segment of the cycle's activities.

Thank you for this opportunity to comment.

Sincerely,

Raul H Castro

Raul H. Castro
Governor

RHC:evp

S-8

EXECUTIVE CHAMBERS
HONOLULU

GEORGE R. ARIYOSHI
GOVERNOR

July 15, 1975

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs (AW-558)
United States Environmental
Protection Agency
Washington, D.C. 20460

Dear Dr. Rowe:

Thank you for allowing us to review and comment on the Draft Environmental Statement for a Proposed Rulemaking Action Concerning Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle. Please be informed that we have no objections to the proposed rulemaking action.

At this time, a nuclear power plant of the smallest commercial size available (550-600 megawatts) could not be fit into the electrical distribution system of Oahu before the year 2000. In addition, there is also the question of licensing a nuclear plant in Hawaii from the standpoint of geology and seismology. As a result, nuclear power plants as an alternative energy source for Hawaii is not foreseen in the near future.

With warm personal regards, I remain,

Yours very truly,

George R. Ariyoshi

S-9

STATE OF NEVADA
GOVERNOR'S OFFICE OF PLANNING COORDINATION
CAPITOL BUILDING
CARSON CITY, NEVADA 89701
(702) 885-4865

July 22, 1975

W. D. Rowe
Deputy Assistant
Office of RAdiation Programs
US Environmental Protection
Washington, D. C. 20460

RE: Radiation Protection Requirements for Normal Operations
SAI NV 75800040

Dear Mr. Rowe:

Thank you for the opportunity to review the above mentioned project.

The State Clearinghouse has processed the proposal and has no comment. Based on the information contained therein and the responses of interested parties, the proposed project is, as of this date, found not to be in conflict with the State's plans, goals or objectives.

However, Comprehensive Health wishes to know whether the protection requirements are minimal or maximal. Please answer this question directly to Comprehensive Health with a carbon copy to this office.

Sincerely,

Bruce D. Arkell
State Planning Coordinator

BDA/tls
cc: Comprehensive Health

S-10

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

July 23, 1975

Mr. W.D. Rowe
Deputy Assistant Administrator
for Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Rowe:

Staff members of this department have reviewed the draft Environmental Impact Study for the proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle. The standards which are proposed in this document appear to be compatible with the philosophy of keeping the radiation exposure to the public as low as practicable. I believe that the proposed standards can be regarded as acceptable.

Sincerely,

Joseph N. Gill

Joseph N. Gill
Commissioner

cc: CEQ, Washington
Bill Kraynak

JBG/eca

S-11

Minnesota Pollution Control Agency

July 28, 1975

Director
Criteria & Standards
Office of Radiation Programs
U. S. Environmental Protection Agency
Washington, D. C. 20460

Dear Sir:

Proposed New Part 190 to Title 40
Environmental Radiation Protection
Standards for Nuclear Power Operations

In §190.02(b) Uranium Fuel Cycle is defined by naming functionally different operational facilities. Neither high-level nor low-level radioactive waste management facilities are specified as parts of the UFC. Such facilities can release radioactive materials into the environment and, therefore, should not be excluded from UFC. The same section excludes the reuse of recovered non-uranium fissile products of the cycle. When Plutonium Recycle is authorized by NRC, any nuclear power plant using mixed oxide fuel and any facility that is in any way involved with such fuels would not be subject to new Part 190. The new Part 190 should unambiguously provide to include all facilities the fabricate, use, or reprocess mixed oxide fuels in order that the rule shall apply to such facilities.

In §190.10(b) release limits for long half-live radionuclides during normal operations are specified. The rule reads "The total quantity of radioactive materials entering the general environment from the entire uranium fuel cycle, per gigawatt-year of electrical energy produced by the fuel cycle, shall contain less than 50,000 curies of krypton-85, 5 millicuries of iodine-129, and 0.5 millicuries combined of plutonium-239 and other alpha-emitting transuranic radionuclides with half-lifes /sic/ greater than one year." It is not clear how these limits

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Equal Opportunity Employer

are to be calculated. Are they to be computed on a periodical basis using only the quantity released and the energy produced during the period or on a cumulative basis wherein the total cumulative release limits are tied to the total cumulative energy produced or on some other basis. This point should be clarified in the final rule. The release limit for iodine-129 is five times larger than the minimum expected industry performance which has been cited to be about 1 millicurie per gigawatt-year.* A five-fold allowance is overly generous in terms of the EPA intent to propose standards that are not permissive with respect to public exposures and long-term environmental releases. The iodine-129 limit should be reduced by at least 3 millicuries per gigawatt-year to 2 millicuries per gigawatt-year.

In §190.11, allows standards specified in §190.10 to be exceeded if the regulatory agency has granted a variance based upon its determination that a temporary and unusual operating condition exists and continued operations is necessary to protect the overall societal interest with respect to delivery of electrical power. What constitutes "unusual" is not defined. No upper bound to annual radiological exposure doses or radionuclide release limits for unusual operations is mentioned or implied. What constitutes "temporary" is not defined. No variance time limit is implied. No provision for plant derating or shutdown exists in the event "temporary" is exceeded. These deficiencis should be remedied in the final rule, because societal interest includes public health and safety as well as a right to electricity.

The foregoing constitutes the Minnesota Pollution Control Agency comments to the proposed new Part 190 to Title 40 CFR.

Yours truly,

Peter L. Gove
Executive Director

PLG/re

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* EPA-520/4-73-002 Environmental Radiation Dose Commitment: An Application to the Nuclear Power Industry, Tables 1 and B.5.

S-12

State of Wisconsin \ DEPARTMENT OF HEALTH AND SOCIAL SERVICES
DIVISION OF HEALTH
MAIL ADDRESS: P. O. BOX 309
MADISON, WISCONSIN 53701
IN REPLY PLEASE REFER TO:

July 29, 1975

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs (AW-558)
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Dr. Rowe:

The environmental statement mailed to Governor Lucey on June 3 relating to proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle was referred to this agency for response. Attached are our comments.

Sincerely,

George H. Handy, M.D.
State Health Officer

GHH:dv
attachment

cc: Governor Patrick J. Lucey
Wilbur J. Schmidt

FORM AD-31

DEPARTMENTAL CORRESPONDENCE

To George H. Handy, M.D.
State Health Officer

From Lawrence J. McDonnell, Chief
Section of Radiation Protection

Subject

Date July 28, 1975

COMMENTS ON ENVIRONMENTAL RADIATION PROTECTION REQUIREMENTS FOR NORMAL OPERATIONS OF ACTIVITIES IN THE URANIUM FUEL CYCLE

We recognize that the U. S. Environmental Protection Agency is responsible for establishing environmental radiation standards and in general we are not in a position to comment on the proposed numerical values selected by EPA. However, one serious question does arise. If, as expressed by the National Academy of Sciences, the current Radiation Protection Guide is unnecessarily high the health risks involved must have been unnecessarily high in applying the current guide. The thrust of the new proposed radiation standards simply reinforces many fears already entertained by people in that the government has not provided adequate guides in matters of radiation protection. I feel that this point should be clarified if the current guides are too high;what dangers, if any, have we in the general population already been exposed?

The Wisconsin Division of Health has conducted environmental radiation surveys in and around nuclear power facilities located within the state since 1966. We understand that the NRC has responsibility to implement the proposed standards at the specific facility; however the state continues its interest outside the plant boundaries, and in this respect it is evident that these surveys will necessarily be continued in order to verify that individual sites are meeting the standards. The impact of the proposed standards must be weighed by the state agency responsible for environmental radioactivity surveillance. It is likely that new measuring procedures not presently available to the states will be necessary to insure compliance with the proposed standards when adopted. While it is recognized that certain field measurements have been conducted and are included in the Draft Environmental Statement, it is recommended that the Environmental Protection Agency provide the state detailed procedures and necessary laboratory control procedures to insure verification measurements in the environment.

LJM/rv

cc - Mr. H. E. Wirth, Director
Bureau of Environmental Health

S-13

Office of Planning and Budget
Executive Department

James T. McIntyre, Jr.
Director

G E O R G I A   S T A T E   C L E A R I N G H O U S E   M E M O R A N D U M

TO: Mr. W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs (AW-558)
United States Environmental Protection
Agency
Washington, D.C. 20460

FROM: Charles H. Badger, Administrator
Georgia State Clearinghouse
Office of Planning and Budget

DATE: August 7, 1975

SUBJECT: RESULTS OF STATE-LEVEL REVIEW

Applicant: U. S. Environmental Protection Agency

Project: Draft Environmental Impact Statement (F.R. Doc. 74-24350)

State Clearinghouse Control Number: 75-06-26-13

The State-level review of the above-referenced document has been completed. As a result of the environmental review process, the activity this document was prepared for has been found to be consistent with those State social, economic, physical goals, policies, plans, and programs with which the State is concerned.

The following State agencies have been offered the opportunity to review and comment on this project:

Georgia Department of Natural Resources, inclusive
of historical and archaeological sections
Office of Planning and Budget, Executive Department

cc: Gary Midkiff, OPB
Ray Siewert, DNR

270 Washington St., S. W. · Atlanta, Georgia 30334

SC-EIS-4
July 1975

State of Ohio Environmental Protection Age Box 1049, 361 East Broad Street, Columbus, io 43216 (614) 466-8565

S-14

August 6, 1975

Re: Draft Environmental Statement, Environmental Radiation Protection Standards for Normal Operations of Activities in the Uranium Fuel Cycle.

James A. Rhodes
Governor
Ned E. Williams, P.E.
Director

OhioEPA

Office of Radiation Programs
Criteria and Standards Division
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Gentlemen:

The Ohio Environmental Protection Agency has been charged, by the Governor, with lead agency and review coordination responsibilities for the State of Ohio on Federal Environmental Impact Statements. The above mentioned Draft Environmental Impact Statement has been reviewed by sections of this Agency, and the Ohio Power Siting Commission.

The DEIS is generally very well done. However, there seems to be an unresolved conflict between the ALAP criteria of the (former) AEC and the present EPA rulemaking. The NRC usually requires a 15 mrem fencepost dose per reactor. Even when the dose is lower (usually in the neighborhood of 6-8 mrem per unit), any multi-unit site or reprocessing plant would have difficulty in meeting the 25 mrem dose required by the new rule-making.

Table 8 (page 66) has a seeming lack of consistency in that doses of 25, 75 and 25 mrems are set down in section A irrespective of unit size or electricity generated and then Section B sets down standards based on units per gigawatt-year of electrical energy generated. Application of the standards could cause undue confusion in the field.

There is also a problem in controlling Krypton 85 releases. The present state of technology seems to leave much to be desired, especially in the area of controlling concentrated amounts of Krypton 85.

The following minor points should be clarified:

1. Page 10 - first paragraph - The statement concerning sensitivity on biota other than human should be referenced, if at all possible. The reviewers are not aware of any studies on radio sensitivity of these lower forms of life.
2. Page 10 - second paragraph - The discussion of health effects is crucial to the whole EIS and should be expanded to explain why life-shortening criteria are not used. It would be well to repeat some of this on page 22, or to refer to this section on page 10.
3. Page 11 - top - It should be made clear that the limit discussed was 170 mrem above background.
4. Some of the terms in the graphs and Tables are not clear (e.g. PGIE, BGIE). We suggest a glossary of terms and abreviations in the Appendices.

We appreciate the opportunity to comment on this DEIS and hope that our comments will aid in the preparation of the Final EIS.

Very truly yours,

Ned E. Williams, P.E.
Director

NEW/cp
31503.0

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Ogden Reid,
Commissioner

August 12, 1975

Director, Criteria and Standards
Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Sir:

The State of New York has reviewed the proposed 40CFR190, "Environmental Radiation Protection Standards for Nuclear Power Operations" and the associated Environmental Protection Agency's (EPA) Draft Environmental Statement dated May 1975. The State of New York supports the adoption of the EPA proposed standards since they will:

1. Limit radiation doses to the general public and quantities of long-lived radioactive materials in the general environment, attributable to operations involving the uranium fuel cycle for electrical power generation.

2. Help to expedite issuance by NRC of "as low as practicable" guidelines for the non-reactor components of the uranium fuel cycle, especially fuel reprocessing and fuel fabrication operations.

However, it is felt that EPA should propose standards not only for those activities of the uranium fuel cycle which relate to the generation of electric power but for all other activities related to the use of uranium, including military, educational, and medical uses which would not be regulated by the presently proposed standards.

The State supports the concept of limits in curies per gigawatt year for prevention of environmental buildup of long-lived radionuclides. (The Department of Environmental Conservation has previously identified a potential problem due to the release of iodine - 129 at the Nuclear Fuel Services reprocessing plant at West Valley, New York. The problem should be alleviated by the proposed standards.) The State also urges that a high priority be given to the development of a standard for carbon-14.

The State supports the twenty-fold reduction in the maximum allowable dose to an individual (25 mrem vs 500 mrem) for fuel reprocessing and other phases of the fuel cycle but notes that for single reactors operating at a site the EPA standards (25 mrem) are higher than the NRC's Appendix I, 10CFR50 limits ("as low as practicable" guides). For sites with three or more reactors, the EPA standard may be the controlling standard.

A number of New York State agencies have commented on the draft environmental statement and the proposed standards. These comments have been collected by this Department and a summary of them is provided in the attachment. In addition, our Department's specific comments about the impact statement are also included in the attached. These comments are all presented so as to assist EPA in preparation of the final environmental statement and subsequent rule-making.

I trust that even though these comments have been submitted past your stated deadline, they will be given full consideration and judged on their merits.

Sincerely,

Theodore L Hullar

Theodore L. Hullar
Deputy Commissioner for
Programs and Research

Attachment

State of New York

Comments on The

"Draft Environmental Statement Concerning Environmental

Radiation Protection Requirements For

Normal Operations of Activities In The Uranium Fuel Cycle"

By The

U. S. Environmental Protection Agency

Office of Radiation Programs

Issued May 1975

1. General Comment - The statement should contain a detailed epidemiological appraisal of radioactive discharges for normal operations of activities in the uranium fuel cycle.

2. General Comment - The proposed standards are based upon potential health effects vs cost. The statement should thoroughly discuss other environmental standards such as effluent standards for SO_2, NO_x, CO, Particulates, etc.) and compare the health effects bases of these standards to that of the proposed standards.

3. General Comment - The statement should contain a detailed cost-benefit analysis covering the impacts of the proposed standard, otherwise one may be left with the feeling that it may be of significantly greater benefit to society as a whole for the nuclear industry to take the money necessary to meet the proposed standards and donate it to cancer research, etc., and allow operation under the old standards.

   This view is reinforced by the BEIR report (p.8) which states "it is becoming increasingly important that society not expend enormously large resources to reduce very small risks still further, at the expense of greater risks that go unattended."

   Since the statement rightfully recognizes the unusual opportunity mankind has in managing future growth in the use of nuclear energy in a preventive rather than in a remedial context, a detailed cost benefit approach is essential to providing sound precedent in the area of preventive environmental contamination standards.

4. General Comment - If the dose standards in Part 190.10a are to be determined on a realistic assessment basis, the environmental statement should explain why the more conservative and more readily determined approach of applying the standards to a hypothetical man at the site boundary ("fence-post-dose") is not a more practicable approach and limit.

5. General Comment - The Department of Health noted that the reduction in the individual dose limits in the proposed standards for normal operation of the uranium fuel cycle is a desirable goal. This assumes that these limits are attainable with current technology and at a cost commensurate with the reduction of risk as indicated in the Draft Environmental Statement.

6. General Comment - The Department of Health states that the proposed limits for the long-lived radionuclides raise questions. For example, have other environmental consequences such as a potential increase in solid wastes been considered in attempting to attain the limits for Kr-85, I-129 and the transuranics? It is suggested that the final environmental statement address itself to this problem.

7. General Comment - The Public Service Commission (PSC) noted that the standard for Krypton-85 (i.e. 50,000 curies per gigawatt year) proposed in these rules is more restrictive than the existing NRC standard. It will require the reprocessing industry to construct and operate Krypton recovery systems to limit emissions. These new systems will of course add to the cost of reprocessing. It is suggested by PSC that EPA ought to provide a benefit/cost analysis, perhaps expressed in dollars per man rem saved, to determine whether this particular standard is justified. The International Commission on Radiological Protection Report 22, specifically Appendix III, and "Human Costs of Nuclear Power," by Sagan, in Science, Vol. 177, pp. 487-493, should be useful in the preparation of such an analysis.

8. General Comment - The Department of Commerce stated that Kr-85 removal and storage technology sufficient to meet the proposed standards is not currently available and hence it is not clear that the cost estimated in the Draft Environmental Statement accurately reflects the true monetary cost of implementing the proposed standards. These monetary costs should also include the costs necessary to protect the workers who will operate the krypton removal equipment and the krypton storage facility. The radiological risk to the public as well as the worker in the event of unplanned releases from the storage facility should also be considered.

9. General Comment - The Department of Commerce stated that EPA proposes a whole body dose limit of 25 mr/yr from a given site. The gamma dose from the decay of N-16 in the turbines at the Nine Mile Point power station in New York State is given in Table 5 of the Draft Environmental Statement as 12 mr/yr based on 100 hours occupancy per year in a boat at the point of nearest approach to the facility. It is recommended by Commerce that EPA consider, in its estimation of the monetary cost to society for implementing these standards, the added cost (extra shielding, greater setback of turbine from river, etc.) necessary to insure that multiple plants on the same site do not exceed the proposed whole body limit of 25 mr/yr.

10. General Comment - The Department of Commerce notes that according to the State Health Department, the current cancer rate in Upstate New York is 30,000 cases per year (excluding skin cancer); in addition there are 900 to 1,000 cases of leukemia and 1,100 live birth malformations per year. This is to be compared with EPA's very conservative estimate of a total nationwide reduction of 1,000 effects (cancer, leukemia, and serious genetic defects) by the year 2000 (at a cost of $100,000 per effect) if the proposed standards are implemented. It should be noted that because of the conservative assumptions inherent in this estimate, these "effects" may in fact never occur. The Department of Commerce wonders if the few percent "tax" ($100,000,000) to be placed on the public's electrical energy bill via the implementation of these standards would not better serve society if spent in other ways.

11. General Comment - It is recommended by the Department of Commerce that, in the implementation of dose standards, the dose estimates for each site be based on realistic calculations and field data rather than on unrealistic worst case assumptions (e.g., not arbitrarily assuming 100% occupancy at fence post).

12. p V. - Summary - A statement is made on the total reduction in potential health effects through the year 2000. It is not clear whether the reduction of "1000 cases" is attributable solely to the proposed standards for long-lived radionuclides or if the reduction includes the proposed individual limits. This should be clarified.

The New York State Department of Health notes that the current annual cancer rate in Upstate New York is 30,000 cases (excluding of skin cancer) with an additional 900 to 1,000 cases of leukemia. It is difficult to ascertain the statistical significance of a total reduction of "1000" cases" nationwide to the year 2000.

13. p 37 - Section V.A. - There is a large discrepancy between the NRC's proposed interim guide of $1,000 as the value of a man-rem saved and the EPA's estimated cost of implementing the standards as less than $75 man-rem saved. The data presented in the curves on page 37 of the draft environmental impact statement show that at some point there is little reduction in risk for large expenditures of money. The expenditure of large sums of money with the associated man-hours of labor would have some associated health effect, which has not been presented. EPA should join with NRC in establishing appropriate monetary values for the worth of reduction of radiation doses to the population.

14. p 56 - Section V.B. - It is stated that in the environmental statements only two BWR sites, Nine Mile Point and Bailly, project boundary doses from gamma radiation originating onsite greater than 5 mrem/year to individuals. It is further stated that "In one of these cases (Nine Mile Point) the dose can be reduced by restricting boating near the discharge canal." Yet, the statement fails to show how boating can legally be restricted on Lake Ontario around the Nine Mile Point discharge.

The other case (Bailly) is stated as appearing to be "unnecessarily high", yet no recommendation for correcting the situation is provided.

It appears that if the gamma dose is "unnecessarily high" for these two cases a redesign of the shielding would be warranted.

15. p 57 - Section V.B. - Table 6 shows that the bone exposure as a result of the Humeca mill operation is 42 mrem/year. In response to this it is stated on p 57, "The single instance of a projected dose significantly exceeding 10 mrem/year is for a facility not projecting use of cost-effective levels of particulate control."

    The draft statement should discuss such facilities which are presently not operating under the limits of the proposed standards and what actions will be necessary to bring such facilities into compliance if the proposed standards are adopted. Such a discussion should also include EPA's views on whether a variance for such "grand father" facilities is being considered.

16. p 68 - Section V.D. - EPA has stated on p 68 that it intends to "consider the appropriateness of more stringent levels for maximum environmental burdens of these persistent radionuclides" as experience is gained concerning the ability of the industry to limit fuel cycle releases of these materials to the environment. EPA should provide a thorough discussion of the technology for control of these long-lived radionuclides.

17. p 68 - Section V.D. - It is stated that "as knowledge becomes available concerning the capability of technology to limit environmental releases of tritium and carbon - 14, the appropriate levels of environmental burdens of these radionuclides will be carefully considered by the Agency." The environmental statement should provide an assessment of the technology controling releases of tritium and carbon-14.

18. p 73 - Section VI - It is stated that "Since the proposed standards are more restrictive than current standards, their environmental and public health impacts will logically be positive and not adverse in nature." It is felt that the assumption that these impacts will be positive and not adverse in nature needs justification in view of the fact that although the standards will result in lower radioactive releases to the environs they may result in high doses to the workers at the uranium fuel cycle facility or even to the general public in case of abnormal releases due to leakage or accidents at storage facilities. It is felt that a thorough cost-benefit analysis should be presented covering each of the proposed standards and their alternatives and then covering the entire standard in comparison to its alternatives.

19. p 82 - Table 10 - The environmental statement should contain a detailed discussion of the linear non-threshold theory versus the threshold theory. Such a discussion should include references to support each viewpoint and fully explain why EPA has chosen the non-threshold theory in formulating its radiation standards.

20. p 81 - Section VI.B - This section should attempt to place the potential health effects attributable to operation of the nuclear fuel cycle in perspective to other fuel cycles such as coal or oil.

21. The draft statement should discuss why non-ionizing radiation is not being regulated to the extent of that of ionizing radiation.

22. p 87 - Section VI.C - The total, capital, operating, and fuel cycle costs for all reactors and fuel cycle facilities planned, ordered, under construction, and operating should be estimated. It is roughly estimated that these total capital costs will exceed $1 billion for LWR's within the next 10 years alone. It is important to note, as the draft statement has done, that these increased costs for LWR's would be required independently of the proposed EPA standards as a result of Appendix I recently issued by NRC.

23. p 90 - Section VI.D - It is stated that Appendix I to 10 CFR 50 has not yet been issued even though it was first proposed almost four years ago. The reason for the delay in adoption of Appendix I and its significance should be discussed.

24. p 93 - Section VI.E - The statement should discuss the impact the proposed standards may have on proposals for disposal of low level radwastes, in particular Tritium, via deep well injection.

25. p 94 - Section VI,E - It is stated that "It is simply assumed that waste Management represents an improvement over disposal." Such a "simple assumption" should be justified since this issue is basic to the "dilute and disperse vs. concentrate and contain" arguments in waste management/disposal.

26. p 96 - Section VI.E - This section should discuss the potential influence the proposed standards may have on the mix between PWR, BWR, and HTGR's.

27. p 111 - Figure 12 - The Department of Commerce notes that in the Draft Environmental Statement EPA indicates the cost of electricity to the consumer to be in the range of 30.00 to 30.25 mills/kilowatt-hour (i.e., Figure 12). The source and the year to which these data apply are not clear. The following data (Atomic Industrial Forum INFO, dated June 1975) for the first quarter of 1975, which includes capital amortization as well as fuel and other operating costs per kilowatt-hour of nuclear and fossil fuel, show the cost of nuclear generated electrical power to be substantially less than 30 mills/KWH. The Department of Commerce feels these data also show the economic benefit to society of nuclear over fossil fuel for electric energy production.

Utility	Coal	Oil	Nuclear
	Cost of Electricity - mills/KWH		
Consolidated Edison		35.40	13.58
Northeast Utilities		30.80	9.63
Rochester Gas & Electric	20.60		9.40
Virginia Electric & Power	22.65	24.42	11.61

EPA's conclusions regarding the percent increase in cost to the consumer of implementing the proposed standards appears to be based on a power cost of approximately 30 mills/KWH. In view of the AIF data for 1975, it appears that the percent increase in cost estimated by EPA in the Draft Environmental Statement should be revised upward.

28. p 112 - Section VII - The Public Service Commission suggests that an alternative which should be considered in the environmental statement is control via an emissions tax.

29. p 135 - Appendix - It is not clear how the proposed standard will be enforced across the entire uranium fuel cycle. A complete discussion of this should be provided.

S-16

CLAIRE T. DEDRICK
SECRETARY

Department of Conservation
Department of Fish and Game
Department of Navigation and
Ocean Development
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814
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Air Resources Board
Colorado River Board
San Francisco Bay Conservation and
Development Commission
Solid Waste Management Board
State Lands Commission
State Reclamation Board
State Water Resources Control Board
Regional Water Quality Control Boards

AUG 1 5 1975

Dr. W. D. Rowe
Deputy Assistant Administrator
for Radiation Programs
U. S. Environmental Protection Agency
Washington, D. C. 20460

Dear Dr. Rowe:

This is in response to your letter dated June 3, 1975, to Governor Brown requesting review and comments on the draft environmental statement regarding proposed "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle".

Your draft environmental statement has been reviewed by the Departments of Health, Transportation, and Water Resources; the Energy Resources Conservation and Development Commission; the Public Utilities Commission; the Air Resources Board; the Solid Waste Management Board; and the State Water Resources Control Board.

We have no comments on your statement. Thank you for the opportunity to review and comment.

Sincerely,

CLAIRE T. DEDRICK
Secretary for Resources

By

Air Mail

STATE OF MISSISSIPPI
OFFICE OF THE GOVERNOR

WILLIAM L. WALLER
GOVERNOR

WM. M. HEADRICK
COORDINATOR OF FEDERAL-STATE PROGRAMS

STATE CLEARINGHOUSE FOR FEDERAL PROGRAMS

TO: Dr. W. D. Rowe
Deputy Assistant Administrator
for Radiation Programs (AW-558)
U.S. Environmental Protection Agency
Washington, D.C. 29460

State Clearinghouse Number 75062506
Date: 8/15/75

PROJECT DESCRIPTION: Draft Environmental Statement entitled "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle. U.S. Environmental Protection Agency (Office of Radiation Programs).

(x) 1. The State Clearinghouse has received notification of intent to apply for Federal assistance as described above.

(--) 2. The State Clearinghouse has reviewed the application(s) for Federal assistance described above.

(--) 3. After proper notification, no State agency has expressed an interest in conferring with the applicant(s) or commenting on the proposed project.

(--) 4. The proposed project is: ( ) consistent ( ) inconsistent with an applicable State plan for Mississippi.

(x) 5. Although there is no applicable State plan for Mississippi, the proposed project appears to be: (x) consistent ( ) inconsistent with present State goals and policies.

COMMENTS: The Division of Radiological Health and the Office of Science and Technology advise that, due to personnel assignments in other areas, they are unable to review this EIS in depth and, therefore, have no comments to make at this time.

This notice constitutes FINAL STATE CLEARINGHOUSE REVIEW AND COMMENT. The requirements of U.S. Office of Management and Budget Circular No. A-95 have been met at the State level.

cc: Glen Wood, Jr., Air & Water Pollution
Dr. P. Tal Bankston
Mr. Eddie S. Fuente

Ed May Jr.
Edward A. May, Jr.
Clearinghouse Director

SUITE 400, WATKINS BLDG. • 510 GEORGE STREET • JACKSON 39201 • (601) 354-7570

DOLPH BRISCOE
GOVERNOR

OFFICE OF THE GOVERNOR
DIVISION OF PLANNING COORDINATION

JAMES M. ROSE
DIRECTOR

August 25, 1975

Dr. William A. Mills
Director
Criteria and Standards Division (AW560)
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Dr. Mills:

The draft environmental impact statement, (DEIS) titled "Environmental Radiation Protection Requirements for Normal Operation of Activities in the Uranium Fuel Cycle" has been reviewed by the Governor's Division of Planning Coordination and by interested State agencies in accordance with the National Environmental Policy Act of 1969.

The review participants submitted the following comments which warrant your consideration:

1. The Texas Department of Health Resources (TDHR) commended the Environmental Protection Agency (EPA) for their effort in preparing the DEIS; however, the TDHR expressed serious concern for what they believe to be an insufficient consideration and assessment of the effects which are potentially involved in active and abandoned uranium mines and in the milling of uranium. They also expressed concern for the attempt to quantify the cost of health effects. The TDHR suggested that because of the crucial decision involved in setting this standard, an extensive effort should be made to obtain expert advice and a sampling of opinion from an informed public. In addition, the TDHR made several suggestions for substantive editorial changes.

2. The Texas Department of Agriculture (TDA) expressed strong concern over several important aspects of the DEIS. They stated that the exclusion of the effects from uranium mines is a serious omission and if the new radiation standards are to be effective, they must be applicable to both active and abandoned mines. The TDA questioned the validity of the risk-cost assessment and emphasized the need to include cost estimates and projections from manufacturers and operators of nuclear power equipment. The TDA also stated that the document introduces considerable bias by accentuating the possible adverse impacts of nuclear power plants by quoting calculated limits rather than measured effects which invariably have been found to be lower. The TDA urged that the DEIS be revised to overcome the basis of their concerns.

P. O. BOX 12428, CAPITOL STATION, AUSTIN, TEXAS 78711
Phone 512/475-2427 Offices Located in Sam Houston State Office Building

3. The Texas Water Quality Board (TWQB) stated that the DEIS generally covers the important items of concern to their agency. However, they advised that the discharge of radioactive pollutants into State waters will require a permit from them and the discharge must comply with the effluent limitations established for the stream segment involved.

4. Dr. T. T. Sugihara, Director of the Cyclotron Institute at Texas A&M University stated that the proposed standards seem reasonable and demonstrate the effective measures taken by the Atomic Energy Commission, Energy Research and Development Administration and Nuclear Regulatory Commission to control the routine release of radioactivity. However, he expressed concern about setting standards for limiting the release of radioactive krypton-85, based on technology that is still under development. In addition, he suggested that in estimating the effect of this source of radiation on the world's population, EPA should take into account that most of those affected are non-Americans with widely varying life expectancies.

The Texas Air Control Board and the Texas Parks and Wildlife Department also participated in the review of this proposal. The detailed comments of the review participants are enclosed for your consideration in the revision of the DEIS.

The Division of Planning Coordination concurs in the importance of establishing radiation standards for protecting public health which will permit the nuclear power industry to meet the national requirement for major future growth in electric power capacity. We commend your efforts in preparing the DEIS and recommend that you consider the comments submitted herewith in the revision of that document. If we can be of further assistance, please let us know.

Sincerely,

James M Rose
JAMES M. ROSE
Director

JMR/eg
Enclosure

cc: Dr. Fratis L. Duff, TDHR
Mr. Hugh C. Yantis, Jr., TWQB
Mr. Edmund L. Nichols, TDA

Texas State Department of Health

JAMES E. PEAVY, M.D., M.P.H.
COMMISSIONER OF HEALTH

FRATIS L. DUFF, M.D., Dr. P.H.
DEPUTY COMMISSIONER

AUSTIN, TEXAS 78756

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JESS WAYNE WEST, R.PH.

July 18, 1975

Mr. James M. Rose, Director
Division of Planning Coordination
Office of the Governor
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Attn: Wayne N. Brown, Chief
Intergovernmental
Coordination

Dear Mr. Rose:

We have reviewed the document entitled "Draft Environmental Statement: Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle" and have the following comments:

1. The proposed standard is deficient in that it excludes coverage of uranium mining operations. Abandoned uranium mines pose the potential of allowing exposures of up to several hundred millirems to persons who occupy the mine or overburden site in the case of open pit mines. They can produce exposures of up to many rem to the lungs of persons who may visit abandoned underground mines.

2. The statement in the second sentence on Page 27 that "Natural uranium ore (which contains 0.7 percent uranium-235)..." is incorrect. The ore contains approximately 0.1 percent uranium and only 0.7 percent of that 0.1 percent is uranium-235.

3. The statement on the bottom of Page 39, "There are no other types of facilities in the fuel cycle which produce whole body doses of significance in comparison to these types of facilities." is false. Sky-shine from tailings piles at uranium mills or occupancy of abandoned (weakly-mineralized) mine overburden piles can also produce exposures which, by comparison to those quoted for power generating facilities, could only be considered as very high. Radon-222 exposures to lungs can also be quite high compared to the maximum of 14 millirems per year quoted in the DES. While

the potential number of people so exposed is small, this is due largely to the sparseness of mill site population, which can change.

4. One philosophical judgement implied in the DES should be noted. How much money one is willing to spend to avert a potential health effect is another method of asking "how much is a human life worth?" Ours is a technically oriented agency and we feel ill-at-ease in trying to answer this question. The assumptions used in trying to ascertain the numbers of health effects are questioned by some experts, and some conclusions regarding how much money should be spent to avoid health effects calculated using these assumptions are implied in the DES. We believe that the issue has finally been brought to a level where the question of what level of exposures should be permitted can be resolved by considering the opinions of large samples of the informed public. This could require an extensive effort in seeking advice on this one issue. As technical people, we feel comfortable saying "Using certain assumptions, at an exposure of X millirems there will be Y health effects." We feel quite uncomfortable saying that "Industry should spend Z dollars to reduce exposure to X millirems, giving Y health effects".

To summarize, we believe there are parts of the DES which are of great value, and that it is obvious there has been considerable work expended developing the draft. We must nonetheless conclude it is insufficient in that a totally blind eye has been turned on the uranium mining industry and the milling industry has been examined only with foggy vision. It is also our opinion that further comments should be sought concerning the issue of money spent versus health effects saved. That seems to be the crucial decision in setting this standard and it should not be lightly considered.

We appreciate the opportunity to comment on this important work.

Sincerely,

Martin C. Wukasch

Martin C. Wukasch, P.E., Director
Division of Occupational Health
and Radiation Control

EDMUND L. NICHOLS
Assistant Commissioner

July 8, 1975

Mr. Wayne N. Brown, Chief
Intergovernmental Coordination
Division of Planning Coordination
Office of the Governor
Austin, Texas 78711

Dear Wayne:

This is in response to your letter of July 1, 1975, requesting comments on Draft Environmental Statement: Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle.

Our review of this document leads us to believe that it has a significant number of omissions and inconsistencies, and in addition, it appears to be somewhat biased.

The most obvious and probably most serious omission is that it does not include uranium mining. This is the activity with the greatest radiation exposure to individuals. Any new radiation standards must be applicable to this activity if they are to be effective.

This statement claims to balance risks and costs. It states, "...it would be irresponsible to set standards that impose unreasonable costs on the industry..." However, the costs used in determining the proposed standards come exclusively from an AEC report. There are no references used which include cost estimates or cost projections by either a manufacturer or operator such as a utility of nuclear power equipment and plants. In addition, the document gives all costs in 1972 dollar values. These facts can only lead to unbalanced risk-cost assessments. This inconsistency is in great need of resolution. These lead to deception in the risk-cost anaylsis.

The document has considerable bias in that the semantics are chosen to accentuate the possible adverse impacts of nuclear power plants. These are too numerous to tabulate, but in general, the health effects of exposure to low levels of radiation quoted are calculated limits and not measure

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THIS PAPER IS MADE FROM
A PRINCIPAL CROP OF TEXAS
Texas Department of Agriculture, John C. White, Commissioner, P.O. Box 12847, Austin, Texas 78711

effects. The latter have invariably been found to be lower.

We urge that this statement be rewritten to overcome the basic defects listed above.

We appreciate the opportunity to review this environmental impact statement.

Sincerely,

Ed Nichols

Edmund L. Nichols

ELN/pcf

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EXECUTIVE DIRECTOR

PH. (512) 475-2651

1700 NORTH CONGRESS AVE. 78701
P.O. BOX 13246 CAPITOL STATION 78711
AUSTIN, TEXAS

July 23, 1975

Re: Draft Environmental Statement, Environmental Radiation Protection Requirements for Activities in Uranium Fuel Cycle

General James M. Rose, Director
Division of Planning Coordination
Office of the Governor
P. O. Box 12428, Capitol Station
Austin, Texas 78711

Dear General Rose:

The staff of the Texas Water Quality Board has reviewed the draft environmental statement for the environmental radiation protection requirements for normal operations of activities in the uranium fuel cycle and find the statement to cover the important items of concern to this agency. In Texas, any discharge into State waters requires a permit from the Texas Water Quality Board, which would cause this agency to become involved in this program if the radioactive pollutants were discharged via water pathways. The discharge would be required to comply with the effluent limitations established for the particular stream segment used for the pathway.

We appreciate the opportunity to review this environmental statement. If we can be of further assistance, please let us know.

Very truly yours,

Emory G. Long

Emory G. Long, Director
Administrative Operations

TEXAS A&M UNIVERSITY
COLLEGE OF SCIENCE
COLLEGE STATION, TEXAS, 77843

CYCLOTRON INSTITUTE
Office of the Director

Area Code 713
845-1411

JUL 23 1975

July 22, 1975

Mr. Wayne N. Brown
Division of Planning Coordination
Office of the Governor
411 W. 13th St.
Autin, TX 78701

Subject: Draft Environmental Statement: Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle

Dear Mr. Brown:

In general the standards proposed by the EPA for environmental radiation protection in connection with the uranium fuel cycle seem reasonable. The technical considerations on which the arguments are based come principally from the AEC and demonstrate clearly the effective measures taken by the AEC, ERDA and NRC to control routine release of radioactivity. The proposed standards would codify present practices.

While I have no expertise in the technology of limiting the release of ^{85}Kr, it seems to me as a scientist that it may be premature to set standards based on a technology that is still under development. One wonders also whether in estimating the effect of ^{85}Kr on the world's population, the EPA took into account that most of those who would be affected are non-Americans with widely varying life expectancies.

Sincerely,

T. T. Sugihara

T. T. Sugihara
Director

TTS:sd

TEXAS AIR CONTROL BOARD
PHONE 512/451-5711
8520 SHOAL CREEK BOULEVARD
AUSTIN, TEXAS - 78758

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July 14, 1975

Mr. Wayne N. Brown, Chief
Intergovernmental Coordination
Office of the Governor
Division of Planning Coordination
P. O. Box 12428, Capitol Station
Austin, Texas 78711

Dear Mr. Brown:

Our agency has reviewed the Draft Environmental Statement: Environmental Radiation Protection Requirements for Normal Operating of Activities in the Uranium Fuel Cycle. We have no comments to make concerning this document.

Thank you for the review opportunity. If we can be of further assistance, please contact me.

Sincerely yours,

Bill Stewart

Bill Stewart, P.E.
Director
Control and Prevention

TEXAS
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July 15, 1975

Mr. Wayne N. Brown
Division of Planning Coordination
Executive Department
Box 12428, Capitol Station
Austin, Texas 78711

Dear Mr. Brown:

This Department has reviewed the draft environmental statement on radiation protection requirements for normal operations of activities in the uranium fuel cycle.

We offer no comments on this statement.

Thank you for the opportunity to review the document.

Sincerely,

CLAYTON T. GARRISON
Executive Director

CTG:WJS:sb

COMMONWEALTH of VIRGINIA
Council on the Environment

GERALD P. McCARTHY
ADMINISTRATOR

903 NINTH STREET OFFICE BU
RICHMOND 23219

August 27, 1975

Dr. W. D. Rowe
Deputy Assistant Administrator
  for Radiation Programs (AW-558)
U.S. Environmental Protection Agency
Washington, D.C. 20460

Subject: Draft Environmental Statement Regarding the Proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle

Dear Dr. Rowe:

We have completed our review of the subject document. The State Water Control Board and the Department of Health, Radiological Health Section and Bureau of Industrial Hygiene have assisted us in this review.

Based on the comments we received, and our own evaluation of the requirements, we offer the following observations:

The standards proposed by the Environmental Protection Agency appear quite "tight" but considerable lead time is allowed before they become effective, and provision is indicated for systematic review as time goes on.

Thank you for the opportunity to comment.

Sincerely,

Gerald McCarthy

GPM:dls

cc: Mr. A. Gordon Brooks, Executive Assistant, Governor's Office
Honorable Earl J. Shiflet, Secretary, Commerce and Resources
Mr. Oscar H. Adams, State Department of Health

STATE OF OKLAHOMA
OFFICE OF THE GOVERNOR
OKLAHOMA CITY

DAVID L. BOREN
GOVERNOR

September 23, 1975

W. D. Rowe, Ph. D.
Deputy Assistant Administrator for
Radiation Programs
Environmental Protection Agency (AW-558)
Room 611, Waterside Mall East
401 M Street, S. W.
Washington, D. C. 20460

Dear Dr. Rowe:

This is in response to your request for review and comments on the environmental impact statement concerning the radiation protection requirements for normal operations of activities in the uranium fuel cycle.

Members of the staff of the Occupational and Radiological Health and their comments follow:

> Our comments are related to the feasibility of the proposed standards as displayed in Table 8. We certainly agree that limitations should be placed on radioactivity releases from facilities within the uranium fuel cycle such that the exposure of individuals and the general public are held to levels as low as reasonably possible. However, our concern is with the degree of difficulty which may be encountered in the determination, either on an absolute or presumptive basis, of adherence to these proposed standards by the regulated industries and/or state health agencies charged with radiation protection responsibilities. The current state-of-the art of determinations of environmental radioactivity, the difficulties in detecting and separating the dose due to natural radioactivity from that released from uranium fuel-cycle facilities and the complex process of accurately assessing the actual dose received by an individual from the emissions of such facilities are the basis for our concern. If our concern is valid, then it follows that field studies and other associated activities to show compliance with the proposed standards may become quite costly - costs to state government due to federally-mandated programs or requirements are receiving close scrutiny at this time in Oklahoma - and thereby reduce the cost-benefit ratio of the proposed standards.
>
> In a related manner, the proposed limitation on the dose to people is given for the entire uranium fuel cycle which is composed of several separate and distinct types of operations which can be easily identified. Any attempt to impose limitations on an individual facility will result in an extremely cumbersome and unwieldy plan of action with respect to the dose contribution from that facility and will probably neglect at least some portion of the dose contribution to those individuals from the fuel cycle. Some guidelines as to how the limitations will be imposed upon specific portions of the fuel cycle (and perhaps upon individual facilities) are mandatory.

It is hoped that these comments will be of assistance to you in the further consideration of these proposed standards and the preparation of a final environmental impact statement.

Sincerely yours,

David L. Boren

DAVID L. BOREN

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401

July 25, 1975

Director
Criteria and Standards Division (AW-560)
Office of Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Sir:

We appreciate the opportunity to comment on the proposed standard, "Environmental Radiation Protection for Nuclear Power Operations," 40 CFR Part 190, and the accompanying Draft Environmental Statement, "Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle." We have reviewed both documents and offer the following comments for consideration.

General Comments

1. The Draft Environmental Statement does not provide a sufficient basis for adopting a regulation with the profound implications of the proposed radiation standards. The breadth of the information that should be considered, particularly in regard to uranium mills and fuel reprocessing plants, can best be developed in a rule-making hearing that permits a full record to be developed. This would permit sufficient time to permit interested persons to carefully examine the assumptions, cost estimates, state-of-the-art control technology, and dose models.

2. Insufficient consideration has been given to the costs of meeting the proposed standards for uranium mills and reprocessing facilities. Control of radioiodine at reprocessing plants (assumed 99.9 percent removal efficiency) is critical to meeting the standards, as is attainment of a decontamination factor of 1,000 for ^{85}Kr. Yet the control technology for radioiodine and ^{85}Kr is only in the laboratory or pilot plant stage. There is no certainty that the anticipated decontamination factors will be attained in a full-sized reprocessing facility.

3. The Draft Environmental Statement (DES) gives little attention to the difficulties and costs in meeting the standards for uranium mills and fabrication facilities. Table 6 of the DES indicates that little information is being considered on the impacts of these facilities. Full development of such information is essential in considering the adoption of such standards.

4. There is a possibility that reactor sites having multiple BWR units may have difficulty meeting the EPA standard. For example, a direct plus air-scatter total body dose rate from the turbines of a 2-unit BWR, plus a gaseous release from the plant of 5 mrem/yr/unit as allowed by Appendix I to 10CFR50, could result in a failure to meet the proposed EPA total body dose limits of 25 mrem/yr on a calculational basis. This is not consistent with the statement from 10CFR190 (page 20, last line) which says that Appendix I "will provide an appropriate and satisfactory implementation of these proposed environmental radiation standards for the uranium fuel cycle with respect to light-water-cooled nuclear reactors utilizing uranium fuel." This illustrates the importance of determining the procedures for implementation of these standards before they are promulgated.

5. It is not clear from reading the introductory material to 40CFR190 that the proposed EPA standard considers Appendix I 10CFR50 as adopted, rather than proposed. There are at least two instances where the word "proposed" is used in this introductory material in referring to Appendix I. The EPA standard should take into consideration the issued version of Appendix I and not the proposed version.

6. Since the standard embraces the entire uranium fuel cycle, it is not clear how the NRC would apportion the curie releases of ^{85}Kr, ^{129}I, and the alpha-emitting transuranics among the individual fuel cycle facilities. We feel that it would be extremely difficult for the NRC to administer or enforce such a standard. Again, we urge that implementation procedures should be developed before the standard is promulgated as a rule.

7. While it may be appropriate to use a linear, nonthreshold dose-risk model for standards setting, the DES treats this hypothesis as if it were real. The DES and the material supportive to the proposed standard should emphasize that the BEIR model used is only a hypothesis.

8. Throughout the standard, the words "annual dose commitment" should be used when referring to the internal exposure pathways.

Specific Comments on the Proposed Standard

1. TECHNICAL CONSIDERATIONS, page 9, second paragraph, third line--The annual thyroid dose limit of 75 mrem does not clearly state whether it applies to an adult or to the limiting case of a child.

2. TECHNICAL CONSIDERATIONS, page 10, first line--The annual release limit of 50kCi of KR-85 corresponds to almost a factor of 7 reduction in the

source term of the assumed "typical" reprocessing plant as presented in "Environmental Survey of the Nuclear Fuel Cycle" (AEC, November 1972) when normalized to the same fuel cycle support basis of 1,000 MWe for a year. The reason for this difference in source terms should be clearly explained.

3. IMPLEMENTATION OF THE STANDARDS, page 19, lines 1-4--Regarding the statement that "Once a given quantity...individual dose limitations.": We believe that this philosophy will lead to flexibility in the rate of release of long-lived radioactivity from individual facilities. However, it should be emphasized that each facility should maintain releases as-low-as-readily-achievable consistent with maintaining a reliable source of power. This would be particularly important where several facilities are located in a complex at a single site.

4. SUBPART B, §190.10(a), page 26--This paragraph should indicate in a clearer manner that the standard includes sources of direct radiation from the facility as well as radioactive effluent releases to the air and water pathways. With the present wording, it is easy to overlook this important fact.

5. TECHNICAL CONSIDERATIONS, page 17, the full paragraph--We agree that "...the problems associated with radon emissions are sufficiently different from those of other radioactive materials associated with the fuel cycle to warrant separate consideration...". TVA will look forward to reviewing and commenting on EPA proposed standards regarding management of radon and its daughter products after these proposed standards have been developed.

6. SUBPART B, §190.12, page 26--TVA believes that a period in excess of two years may be necessary to bring existing operating facilities into compliance with the proposed regulation. Therefore, consideration should be given to exempting operating facilities for a period extending past the effective date.

Sincerely yours,

Peter A. Krenkel, Ph.D., P.E.
Director of Environmental
Planning

United States Department of the Interior
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-75/552

AUG 8 1975

Dear Dr. Rowe:

Thank you for your letter of June 2, 1975, requesting our comments on the Environmental Protection Agency's draft environmental statement on the proposed Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle.

We have reviewed the statement together with the proposed rulemaking published in the Federal Register May 29, 1975. Our comments are presented according to the format of the statement or by subject.

Objectives of Standards

We concur in particular with the consideration given to the long-term impact of the release of longlived radionuclides to the environment. Continuing studies will be required to determine whether additional radionuclides should be specifically limited.

Groundwater

The need for further assessment of radon emissions is discussed in the Federal Register notice on page 23423. Excessive radon occurs in some groundwaters; research on this source should accompany the assessment of man-made sources of radon emissions, if eventually meaningful standards are to be set.

Rationale for Standards

We agree that the process of cost-effective health-risk minimization seems to be the most logical and practicable standards-setting method with the current status of knowledge of effects and technology, assuming, as indicated, that all standards are subjected to continuous scrutiny and reevaluation as new information becomes available.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

August 29, 1975

Mr. William Rowe
Deputy Assistant Administrator
  for Radiation Programs
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Rowe:

The draft Environmental Impact Statement for Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle has been reviewed by the Department of Commerce. The following comments are offered for your consideration.

This draft statement discusses proposed rulemaking by the Environmental Protection Agency to limit radiation doses to the general public and quantities of long-lived radioactive materials in the general environment due to planned operations of all elements in the nuclear fuel cycle, including milling, conversion, enrichment, fuel fabrication, light-water-cooled reactors, fuel reprocessing, and transportation of radioactive materials in connection with any of these operations.

Under the proposed new rule, the maximum annual radiation doses to individual members of the public resulting from fuel cycle operations would be limited to 25 millirems to the whole body and all other organs except the thyroid, which would be limited to 75 millirems.

The proposed rules would also limit release of certain long-lived radioactive pollutants to the local, national and global environment, specifically krypton 85, iodine-129, and alpha-emitting transuronics. No rulemaking is proposed for other long-lived radioactive effluents, tritium and carbon-14.

Variances from these proposed rules would be allowed, to be granted by the licensor (presumably the Nuclear Regulatory Commission or the Energy Research and Development Agency).

General

The documents should describe whether or not cumulative health effects of exposure increments from sources other than the fuel cycle, especially natural sources, have already been considered in setting the suggested standards for maximum doses resulting from exposure to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment from uranium fuel cycle operations.

We hope these comments will be helpful to you.

Sincerely yours,

Deputy Assistant Secretary of the Interior

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
  for Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460

The procedures for variances are written in extremely vague language.

(1) Proposed general population standards from nuclear fuel cycle.

Current Federal Radiation Protection Guides for maximum annual dose to individual members of the public are 500 millirems to the whole body and 1500 millirems to the thyroid from all sources of exposure except those due to medical use and natural background. The proposed new rule would thus reduce current allowed limits for individual exposure for one specific source, the nuclear fuel cycle, by a factor of 20. Medical uses of man-made radiation, which now constitutes the majority of man-made exposure (90%) would remain unregulated. All other sources of man-made radiation would retain the 20 times higher regulated limit of exposure to individuals of the general public.

It should be noted that because the radiation sources involved are localized, the actual reduction in allowed dose is much greater than a factor of 20 for most members of the general public.

The principal argument of the EPA for adopting these proposed new rules is that most operations in the nuclear fuel cycle actually operate at present below these limits. All light-water reactors are presently designed and operated under Appendix I of 10 CFR 50 issued by the Nuclear Regulatory Commission. Limits set by Appendix I are below those of the proposed EPA rules. Some impact will exist for operation of mills, conversion, and fuel fabrication facilities. While the EPA draft statement claims that impact will be small for fuel reprocessing facilities, this is not clear since no fuel reprocessing facilities are presently in operation in the United States and the information base is poor.

The draft statement does not speak at all to possible legal conflicts which might exist due to claimed excessive radiation exposure from different radiation sources, with legal protection limits which differ by a factor of 20.

The EPA approach to rulemaking is very dangerous. The risk to an individual from radiation exposure is independent of the radiation source for similar radiations. Universally applicable rules which apply to one source of radiation and not to others are thus illogical. This is different conceptually from the limits imposed by Appendix I of 10 CFR 50, which is a specific operating limit for a specific operation, light-water power reactors. In any case, if the arguments made by EPA in the draft statement are correct, the present system operates satisfactorily and new rules appear unnecessary. They would, however, contribute to confusion and conflict between federal regulatory agencies, and would involve additional expenditure of federal and state funds for their enforcement.

(2) Proposed limits on release of certain long-lived radioactive pollutants.

A much better case exists for new rules limiting the release from the nuclear fuel cycle of long-lived radioactive pollutants. These pollutants spread throughout the world (especially krypton-85) in an irreversible manner and represent a radiation dose commitment for the future. Two concerns exist regarding these proposed rules. The first is the question of whether technology exists and will be available to satisfy the new rules. This is particularly a concern regarding krypton-85. The draft statement recognizes this concern. It believes that technology will exist, and proposes a possible reversal or delay of the rule if technology is not available. For this situation where no urgent, compelling need for new rules has been demonstrated, this position is unacceptable, if for no other reason than the public alarm which might be created by such a precedure.

The second concern relates to the world-wide aspect of such pollutants. A much better solution would be to work with the International Atomic Energy Agency to develop international rules for such pollutants. Since the concern here is a long term one, not requiring immediate attention, adequate time exists to attempt an international solution, and to develop the appropriate control technology.

(3) Relation of proposed rules to radiation protection guidelines.

The justification for the proposed rulemaking is based in large part upon a study by the National Academy of Sciences-National Research Council's Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR Committee). While mention of other studies is made, no specific mention has been made to the National Council on Radiation Protection and Measurements (NCRP). Report No. 43, Review of the Current State of Radiation Protection Philosophy. This report of the NCRP, the most authoritative body in the United States on radiation protection questions, was issued in January 1975 and is directed primarily to questions raised by the BEIR report. NCRP Report No. 43 with recent national and international studies of these questions, including the BEIR report available to it, was unable to find justification for reduction in presently accepted limits for general population exposure to ionizing radiation.

Conclusions

The EPA justification for proposed new rules which would lower the allowed limits to individual members of the general public resulting from operations of the nuclear fuel cycle is based upon the claim that most of the nuclear fuel cycle operations are already operating below these limits. There is some question as to whether this claim will be true when new fuel reprocessing plants come into operation. Even if the claim is true, there does not seem to be adequate justification to create an extremely illogical radiation protection situation where the source of radiation determines the rule rather than the risk to the public, especially when the existing NRC licensing rules are admitted by EPA to be adequately controlling the situation.

Proposed rules limiting the release of long-lived radionuclides would be desirable; however, the situation is not urgent. Attempts should be made to develop internationally accepted rules through the medium of International Atomic Energy Agency. In any case, new rules should not be promulgated before an assured technical fix is available when the public risk is quite small and uncertain.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We

would appreciate receiving ten copies of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 15 1975

Honorable Russell E. Train
Administrator
U. S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Train:

This is in reply to the notice in the Federal Register, Volume 40 Number 104, May 29, 1975, wherein the Environmental Protection Agency proposed Environmental Protection Standards for the Uranium Fuel Cycle (40 CFR Part 190), and to the letter (Rowe to Muller, June 2, 1975) requesting comments on the Draft Environmental Impact Statement for the rulemaking action.

The NRC strongly supports EPA's mission to develop generally applicable environmental radiation standards. We believe the national interest and our regulatory program would benefit by a numerical expression of safe limits on radioactivity in the ambient environment within which radioactive emissions from the facilities in the uranium fuel cycle could be regulated. Such standards should be developed with full consideration given to the balancing of resource expenditures for health protection for the uranium fuel cycle versus similar expenditures for control of other activities which affect the public health aspects of the environment.

Existing Federal regulations and current regulatory practices provide assurance that for normal operation the uranium fuel cycle facilities will be designed and operated in a manner which limits to as low as reasonably achievable the levels of release of radioactive material and exposures to radiation. In view of the demonstrated effectiveness of the existing regulatory program, we do not believe there is a need for further restrictions for these facilities at this time. Futhermore, any small changes in radiation exposure which might be effected by the proposed EPA standards do not justify the considerable costs associated with the standards. The apparent lack of cost effectiveness should be examined in perspective to reductions which might be afforded by expenditures for control of more significant environmental problems. We believe that EPA's broad responsibilities for pollution abatement and the diverse expertise represented by the EPA staff would permit examination of these trade-offs.

We find that the EPA proposed standards are in reality a "fine tuning" of existing effluent regulations. To demonstrate why this is objectionable, consider the relationship between the EPA proposed standard and the NRC

10 CFR Part 50, Appendix I. The numerical guidelines in Appendix I were derived from a thorough consideration of the costs and environmental effects of radioactive effluents which were presented during a public rulemaking hearing. EPA's proposed standards specify environmental radiation levels for activities in the uranium fuel cycle. Yet, when applied to only one kind of facility within the fuel cycle, light water power reactors, the levels specified by EPA are in the same range as the the guidelines of Appendix I. Furthermore, the EPA proposed standards differ in specific details and are not consistent with Appendix I. The EPA Notice of Proposed Rulemaking states that Appendix I "will provide an appropriate and satisfactory implementation" of these standards for light-water-cooled nuclear power reactors. The NRC staff does not agree that compliance with Appendix I necessarily would provide compliance with the EPA proposed standards. For instance, for a multiple reactor site it would be possible for the emissions to be within the Appendix I levels and in excess of the EPA proposed standards. The EPA proposed standards also would require the scheduled application of technologies which have not been demonstrated on a commercial scale for removing and retaining radioactive iodine and krypton for long term decay and for stabilizing mill tailing piles.

Implementation of the EPA proposed standards would require a substantive effort to modify the NRC's regulations in order to remove these discrepancies, and it would not change significantly the overall environmental impact. Although the proposed standard would require a system for implementation which would be similar in concept to the existing NRC system for regulating effluents, there would be significant differences in the details of implementation which would impose a significant administrative burden on the NRC. It would be particularly difficult to develop a mechanism to demonstrate conformance with the emission limits stated in curies per unit of energy generated.

Thus, we believe that the proposed standard requires further work. The NRC staff believes that EPA's generally applicable environmental radiation standards should provide an upper limit for radiation exposures, predicated upon restricting the potential health impact from all sources of radiation exposure. The Nuclear Regulatory Commission would require its licensees to operate within such limits and further restrict effluent releases and radiation exposures in a cost-effective manner to be as low as reasonably achievable. Several alternative approaches appear available to the EPA. The limits could be raised to reflect the concerns expressed above and in the NRC staff comments which are attached. Another possible approach would be that the Federal Radiation Council (FRC) radiation protection guides for doses to individuals be supplemented to limit doses from the nuclear fuel cycle facilities to a larger fraction of the present FRC limits than the factor of twenty reduction which is reflected in the EPA proposed standard. The fractional limits should be chosen on the basis of a broad and balanced approach to resource expenditures for health protection. The NRC staff is prepared to initiate further work with your staff to develop an appropriate and balanced standard which would allow flexibility within which effluents could be regulated without undue interruptions of electric power sources and with consideration of the proper distribution of allowable discharges among the various types of facilities in the fuel cycle.

Sincerely,

Lee V. Gossick
Executive Director for Operations

Enclosure: Staff Comments

COMMENTS OF THE NUCLEAR REGULATORY COMMISSION STAFF

ON THE

EPA PROPOSED RULEMAKING ON ENVIRONMENTAL PROTECTION STANDARD

40 CFR PART 190

JULY 1975

1. Suitability of the EPA Proposed Standards with Respect to Statutory Authority

Under Reorganization Plan No. 3 the following functions, with respect to radiation standards, were transferred to EPA:

> "The functions of the Atomic Energy Commission under the Atomic Energy Act of 1954, as amended, ... to the extent that such functions of the Commission consist of establishing generally applicable environmental standards for the protection of the general environment from radioactive materials. As used herein, standards mean limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the environment outside the boundaries of locations under the control of persons possessing or using radioactive material."

In addition, a 1973 memorandum from the Director, OMB, to the Administrator of the EPA and the Chairman of the AEC clarified the responsibilities of the two Federal agencies by stating that:

> "EPA should continue, under its current authority, to have responsibility for setting standards for the total amount of radiation in the general environment from all facilities combined in the uranium fuel cycle, i.e., an ambient standard which would have to reflect AEC's findings as to the practicability of emission controls."

The regulatory responsibilities of the AEC were transferred to the Nuclear Regulatory Commission (NRC) by the Energy Reorganization Act of 1974.

It is the view of the NRC staff that the portion of the EPA proposed standard which defines the annual dose equivalent for any member of the public is an appropriate "generally applicable standard" and within the EPA area of responsibility. The actual values proposed in the EPA standard do not adequately reflect NRC's findings as to practicability expressed in Appendix I which was published in the Federal Register on May 5, 1975, as discussed in Section 2, below.

The portion of the proposed standard which specifies limits on quantities of long-lived materials entering the environment is not, in our opinion, a generally applicable environmental standard. These limits which are expressed in curies per gigawatt-year of electric energy generation are, for all practical purposes, discharge limitations for spent fuel reprocessing plants and, in our opinion, represent release limits for a specific type of facility. The proposed approach provides no real limit on the concentrations of these radionuclides in the environment. The use of environmental concentrations would provide a "generally applicable standard" for such long-lived radionuclides.

2. Comparison of the EPA Proposed Uranium Fuel Cycle Standard (40 CFR Part 190) with Appendix I, 10 CFR Part 50

Appendix I of 10 CFR Part 50, which provides numerical guidelines for design objectives and limiting conditions for operation to meet the criterion "as low as reasonably achievable" for radioactive material in light-water-cooled nuclear power reactor effluents, was issued as an NRC regulation on April 30, 1975, with notice in the Federal Register on May 5, 1975.

In addition to satisfying the design objective guidelines, additional radioactive waste treatment components are required by the regulation if the annual costs of those components are justified by reductions of the dose to the population within 50 miles of the reactor using the interim values of $1,000 per person-rem or $1000 per person-thyroid-rem as the basis for judging cost effectiveness.

The statement of considerations published in the Federal Register with the EPA proposed standard 40 CFR Part 190 states in part:

> "It is the view of the Agency (EPA) that this guidance for reactors (Appendix I, 10 CFR Part 50) will provide an appropriate and satisfactory implementation of these (40 CFR Part 190) proposed environmental radiation standards for the uranium fuel cycle with respect to light-water-cooled nuclear reactors utilizing uranium fuel."

The NRC staff does not agree that the provisions of Appendix I would necessarily "provide an appropriate and satisfactory implementation" of the proposed 40 CFR Part 190 for LWR power stations. The reasons are several:

1. The design objective quantities of Appendix I and attendant doses for the three release modes under some circumstances could be additive.
2. The design objectives apply to each reactor on a site (not to the entire site) and can be multiplied by the number of reactors on the site for estimating the equivalent values for the site.
3. The flexibility provided in Appendix I for the limiting conditions for operation (in recognition of the uncertainties in the source term estimates and in anticipated operational occurrences) would permit the design objective quantities to be exceeded under certain conditions.
4. Appendix I applies only to effluents from LWR power stations and does not apply to other radiation sources such as N-16 from the turbines, storage of radioactive material, or interaction of radiation from other nearby sites and radiation from other than LWRs on the same site.

For these reasons, a nuclear power station with only three LWR units designed and operated in accordance with Appendix I could result in the doses presented in Table I.

TABLE I. POTENTIAL ANNUAL DOSE RATES TO AN INDIVIDUAL NEAR A THREE-UNIT LWR STATION OPERATING WITHIN APPENDIX I, 10 CFR PART 50

Release Mode	Whole Body (mrem)	Organ (mrem)
Liquid Effluents	9	30
Gaseous Effluents	15	15
Iodine and Particulates	- -	45
Doses at "design objective"level	24	90
Proposed Standard (40 CFR Part 190)	25	75 (thyroid) 25 (other organs)

The total dose from effluents is almost equal to the EPA whole-body dose and could exceed the organ dose limits. The total dose could be higher than that which could occur from exposure to effluents if consideration is given to radiation from N-16 in the turbine of a BWR station, from storage of radioactive materials onsite, from transportation of radioactive material, from nuclear facilities other than LWR, or from other nuclear sites in the near vicinity of the station site.

3. Conceptual Differences Between Appendix I and the EPA Proposed Standards

There are substantial conceptual differences between the "design objective" and "limiting conditions for operations" features of the NRC 10 CFR Part 50 Appendix I and the standards presented in the EPA proposed 40 CFR Part 190. The design objectives of Appendix I are values which NRC has selected with due consideration of technical feasibility and cost effectiveness. Design objectives are values which the designers and the operators of the facility are to use in selecting station features and operating procedures. A substantial technical effort was undertaken by NRC in order to provide a data base for defining design objective values. Representative values were selected for each of the numerous parameters which are required to be considered in order to estimate the quantities of each radionuclide which might be released and the exposures and doses which might occur as a result of the release.

NRC recognized that each parameter could have a range of values and the selected value was believed to be "realistically" conservative but any particular facility, depending on actual experience, might have greater or lesser releases or impacts than predicted by analytical models used by the NRC staff. NRC also recognized that any particular facility could experience operating difficulties more severe than those assumed in developing the staff analytical models. In recognition of these difficulties in predicting impact, the NRC Appendix I of 10 CFR Part 50 provides for operating flexibility between the "design objectives" and the "limiting conditions" which are reflected in the "technical specifications which define plant operating limits. If the limting conditions are exceeded, the station personnel must report the matter to the NRC, determine the reasons for the higher releases, and determine a course of action which will reduce the releases to the design objective levels. This may be viewed as a graded scale of action rather than a limit.

In contrast, the values proposed by the EPA in 40 CFR Part 190 are limits rather than design objectives, and if they are exceeded the facility presumably would have to cease operations unless the NRC made a "variance" finding that the release was unusual, of a temporary nature, and the societal interests would be served best by continued operation.

4. Direct Radiatiln Exposure from Onsite Sources

The proposed EPA dose limits include dose contributions from direct and scattered radiation arising from radioactive materials which are confined within onsite structures. Appendix I defines as low as reasonably achievable design objectives for radioactive materials in effluents and does not address direct radiation. Dose contributions from this source would be additive to the doses arising from effluents. Neither the Draft Environmental Statement nor the referenced technical documents provide adequate bases for limiting the combined dose due to direct radiation and radionuclide discharges to the proposed limits.

Studies of the direct dose due to N-16 in BWR turbines[1-5] show that the dose rate falls off rapidly with distance from the turbine building and, therefore, does not represent major source of population exposure. Individuals residing near the site boundary could receive whole-body dose contributions from this source. The magnitude of this exposure is very dependent upon plant design conditions (power level, turbine design and shielding, equipment orientation, etc.), upon the geometric relationship of the receptor to the source (distance, direction, and orientation to the turbine axis), and upon the habits of the exposed individual such as the type of residence (which determines shielding) and the amount of time spent at that location (occupancy). Because of the multitude of factors which can affect the exposure, it is difficult to specify the magnitude of the individual dose contributed from this exposure pathway except for specific sites and plants. Appendix A provides calculations which indicate the potential magnitude of these doses. Although parametric studies of turbine shielding have been performed,[6,7] the costs of backfitting shielding installations would be highly dependent upon individual plant design characteristics. Because of the difficulty in formulating a general model for estimating turbine shine, this source of exposure is addressed by NRC on a case-by-case basis in its licensing actions.

5. Fuel Reprocessing Plants - Thyroid Dose Rates

In 1973 the AEC (now the NRC) staff initiated comprehensive engineering, environmental, and cost studies to provide part of the data base for establishing "as low as reasonably achievable" levels of radioactive material in effluents from fuel reprocessing plants.[8]

The initial step in the studies, which were performed at the Holifield National Laboratory (formerly the ORNL), was to develop a model fuel reprocessing plant typical of current design and operation using present licensing limitations on the release of radioactive materials. The cost/benefit of decreasing the release of radioactive wastes through the use of increasingly effective radwaste systems was analyzed. Decontamination factors and source terms were evaluated for each radwaste system. The radwaste systems ranged from present practice to the foreseeable limits of available technology and were analyzed with respect to normal operations. The technology of several of the radwaste systems considered has not been demonstrated on a production basis, and those systems, therefore, are not available for immediate application. Thus, some of the radwaste systems that were considered for purposes of a cost-benefit assessment might not achieve projected removal efficiencies with demonstrated practicability.

Radiological impact on the environment depends upon effluent and site characteristics, population distribution, and land and water uses. Two site regimes, similar to sites previously approved by the AEC, were selected for the study in order to assess the range of impacts from site-related characteristics: a site on a plain in a rural southeastern coastal area adjacent to a continuously flowing stream which empties into an estuary; and a site located on a plain in a rural midwestern environment adjacent to a continuously flowing stream which empties into a large river. Human activities and land and water uses for each site regime were hypothesized and analyzed to determine potential radiation exposure pathways. Doses from identified exposure pathways were calculated for individuals in the vicinity of the plants and for the population within 55 miles of the plants. Hypothetical doses to individuals, to the population, and to organisms near fuel reprocessing plants were evaluated for interaction of radioactive material in effluents from the plants with food and water and irradiation of persons in the environs. Dose models and pathways used in the study to assess exposures are consistent with those used in the licensing of facilities to evaluate the environmental impact from proposed activities. Average meteorologic data from representative midwestern and southeastern coastal regiops were used to calculate average atmospheric dispersion factors for use in calculating doses to individuals and to the population. The dose commitments calculated for these sites might be significantly higher than those that are actually experienced owing to the conservarism introduced into the calculation in lieu of definitive data from operating experience.

The results of these studies indicate that the maximum annual dose commitment via the milk pathway to the thyroid of a child located at a distance of 0.5 mile from the plant could approach 500 mrems per year during equilibrium operations of a plant that reprocessed fuel cooled for 160 days.

A significant fraction of this estimated dose commitment is due to the release of I-129. Therefore, variation in cooling time beyond 160 days would have very little effect on estimated dose rates. The ALAP studies indicate that the dose could be reduced to about 190 mrem per year at a total annual operating cost of approximately $35,000[8] (about $3.80 per person-thyroid-rem on a population basis) using macroreticular resin radwaste treatment equipment. It should be noted that only preliminary laboratory studies have been made of the performance of these macroreticular resins. Development work would be needed to confirm the practicability of the process, which is similar otherwise to conventional ion exchange processes, and to establish suitable methods for resin regeneration and handling of the resins and the spent regenerant. The elapsed time to demonstrate the practicability of this process has been estimated to be three years from project initiation.[8]

The staff believes that this dose rate could be reduced to less than 30 mrem per year by modifying the processing to evolve iodine during disolution and providing additional treatment equipment. This process is not complex, and conventional equipment would be used in a commercial reprocessing plant. The process has been successfully demonstrated on a laboratory scale. However, engineering development and a demonstration of the process with irradiated LWR fuel and dissolver solution are required. It is estimated that the development and design engineering, equipment procurement and installation, start up and testing, and integration into the overall plant circuit could reasonably be accomplished in about 5 years from project initiation in view of the simplicity of the process and the use of conventional equipment. Operation of this equipment could require an annual operating cost of approximately $275,000[8] ($130 per person-thyroid-rem on a population basis).

Recent public hearings have been conducted on the environmental impact of the Barnwell Nuclear Fuel Plant pursuant to the National Environmental Protection Act of 1969 (NEPA). The staff has estimated that normal operations of the Barnwell Nuclear Fuel Plant could yield maximum iodine thyroid dose rates to the thyroid of an infant via the milk and inhalation pathways of 88 mrems per year.[9] This dose rate has been estimated for a location at a distance of 1.5 miles from the facility (i.e., the closest uncontrolled distance from the plant).

On the basis of the above studies, and depending on the location of the nearest "real" cow, it appears that compliance with the proposed EPA standard of 75 millirems per year to an individual's thyroid may not be achievable, with practicability a consideration, within the next 2 years as required by the EPA standard. We note that the EPA report, which is stated to provide the technical backup for the proposed standard, acknowledges that the technology required to control iodine and krypton releases from spent fuel reprocessing plants is "unproven." (EPA-520/9-73-003-D, Table B2, page B15). However, it is likely that plants designed and approved after 1980 could comply with the level of exposure proposed for 1980 in the standard, but the plants then operating might require additional time to modify (backfit) equipment.

6. Fuel Reprocessing Plants - Quantities of I-129 Released

EPA proposes a standard of 5 mCi per gigawatt-year electrical for the release of I-129, with an effective implementation date of January 1, 1983. Studies carried out at the Holifield National Laboratory include consideration of the control of the long-lived radioiodine. I-129 (half life = 1.6×10^7 years).[8] The studies indicate that the use of treatment systems incorporating macroreticular resins, could contain I-129 releases to 62 mCi per gigawatt-year electrical at an annual operating cost of about $35,000 for a model plant. Further NRC staff analysis indicates that this improvement can be reduced to practice in about 3 years from project initiation. The addition of iodine evolution equipment to the reprocessing system is believed to be capable of reducing I-129 releases to about 1.6 mCi per gigawatt-year electrical for a model plant and is estimated to require approximately $275,000 in annual operating costs. Reduction of this advanced equipment to practice is expected to require about 5 years from project initiation. Therefore implementation of the proposed 5 mCi per GWe-year effluent limit for iodine-129 appears to be achievable by 1983.

The improvements listed above have been discussed in relation to thyroid doses of individuals from radioiodine. The EPA proposed standards also address I-129 releases per gigawatt-year electrical. We expect that the installation of radwaste treatment systems to satisfy the proposed individual thyroid dose rate standards also would satisfy the proposed standards related to I-129 release quantity.

7. Uranium Mills - Organ Dose Rates

The function of uranium mills is to extract uranium in concentrated form from naturally occurring ore deposits which generally contain three to six lbs. of U_3O_8 per ton of ore (0.15 to 0.30% U_3O_8). In addition to uranium, the ores contain other radioactive constituents, such as thorium-230, radium-226, radon-222, lead-210, etc., which are radioactive decay products of uranium.

At the beginning of 1974, there were 15 operating mills in the United States, plus one mill on a standby basis. Information regarding these mills is provided in Table II. The nominal capacities of the mills range from 400 to 7000 tons of ore per day.[10]

TABLE II. URANIUM MILLS IN THE UNITED STATES IN 1974

State	Status of Mill	No. of Mills	"Nominal" Capacity Short Tons of Ore Per Day
New Mexico*	Active	3	13,500
Wyoming	Active	7	9,050
Colorado*	Active	2	1,750
Washington*	Active	1	400
Texas*	Active	1	1,750
Utah	Active	1	500
TOTAL		15	26,950
Utah	Inactive	1	1,500

*Agreement states

After ore is received at a mill, it is first crushed and then finely ground into a wet slurry. After the ore has reached a fine sand-like consistency, it is contacted with chemicals which selectively dissolve or leach the uranium from the finely ground solids. The barren solids (tailings) are then separated from the pregnant solution and pumped to waste storage areas (tailings ponds). The pregnant solution is then chemically treated to extract and purify the uranium. The stripped solution is then used as the pumping fluid to convey the solid waste tailings to the tailings pond.

It is important to characterize the locale of uranium mills and the type of radioactive materials that are released. Two primary sources contribute radioactive materials to the atmospheric environment. These are: (1) the release of effluents containing radon and particulates carrying radioactive material from the discharge stacks following in-plant dust collection and effluent treatment; and (2) the escape of radon gas and the wind transport of particulates carrying radioactive material from the tailings area.

Doses from radon are specifically excluded from the standards proposed by EPA. Practicable means are not presently available to control releases of radon from either mill discharge stacks or tailing areas.

The application of existing dust collection techniques will control doses from the releases of airborne particulates from mill discharge stacks to within the standards proposed by EPA.

The major dose contribution from uranium milling is from wind transported particulates from tailings retention systems. The tailings retention systems at uranium mills are constructed similarly to those of other ore dressing and hydrometallurgical plants.[11] In the usual case an initial earth dam is constructed using native soils or mine wastes. Tailings slurries are then discharged along the inner edges of the embankments.

Tailings retention systems range in size from a few acres to hundreds of acres containing millions of tons of tailings. During the construction and operation of tailings retention systems, substantial areas of tailings will form beaches due to evaporation, seepage, and drainage of the liquid fraction of the waste slurry by gravity to lower elevations within the overall waste retention system. Thus, as tailings become exposed by beach formation within these waste retention systems, the finely ground solid tailings, containing the radioactive descendants of uranium, become subject to wind erosion. This erosion, along with the diffusion of radon from tailings systems, results in the dispersal of radioactive materials into the surroundings of uranium mills.

Environmental surveys in the environs of uranium mills have been based on the collection and analyses of airborne samples collected by mill licensees, an AEC program to determine airborne concentrations of radioactive materials around tailings piles at closed mills,[12] an AEC-PHS sponsored program[13] to determine radon concentrations around such systems, and an HEW evaluation of the potential effects of unstabilized inactive

piles on the Colorado River Basin.[14] In addition, limited calculations have been made pursuant to the National Environmental Policy Act to estimate potential exposures to individuals by inhalation only from milling activities at three new mills commencing operations since 1970.[15] Engineering, cost, and environmental studies have also been initiated at the Holifield National Laboratory[16] under the direction of the NRC for the purpose of providing information on "as low as reasonably achievable" effluent releases from uranium mills.

The AEC measurements[12] of airborne concentrations of radioactive materials around tailings piles at inactive mills indicate that airborne concentrations of thorium-230 at 1500 feet from a tailings pile, which had only been inactive a few months and which contained significant moisture, averaged 55% of applicable 10 CFR Part 20 limits. This corresponds to a lung dose rate of about 825 mrem per year from inhalation of thorium-230 alone to an individual continuously present in such an environment. It is recognized that tailings at inactive mills are more prone to wind erosion than those at active mills. The question of ALARA releases from uranium mills is under active study by the NRC staff.

The "as low as reasonably achievable" studies performed by HNL estimate the total maximum annual bone dose rate to a hypothetical individual at 0.5 miles from a theoretical model operating uranium mill and tailings area in Wyoming to be 1060 mrem per year, assuming total occupancy at that location and that 100% of the food consumed is produced locally. It is recognized that this dose rate overestimates reality because of the sparse population in the vicinity of most mills and the unlikely assumption that an individual obtains all his food locally. However, the subject of real doses to real people will require further study before firm conclusions can be reached with regard to establishing the conformance to generally applicable limits as they affect uranium mills.

Recent evaluations[15] of environmental impacts from uranium mills pursuant to NEPA resulted in the calculated dose rate equivalents presented in Table III.

TABLE III. ESTIMATED OFFSITE DOSES FROM URANIUM MILL AIRBORNE EFFLUENTS[15]

Mill	Location	Dose (mrem/year) Bone	Dose (mrem/year) Lung
Petrotomics	Outside Fence	38.6	38
Humeca	Ranch	42	23
Highland	Ranch	3.4-12	1
Shirley Basin	Ranch	0.4	1.0

These calculated dose rates result from inhalation only. These are a small fraction of the 3 rem bone and 1.5 rem lung limits of Part 20. The boundary dose rates are hypothetical, since no individual resides at the site boundaries. The dose rates include radionuclides from the mill and mine ventilation systems, but do not include radionuclides that have become airborne owing to wind erosion of tailings. Again, additional studies would be required to identify the dose to a real individual.

8. Removal of Noble Gases from Fuel Reprocessing Plant Effluents

The principal concern arising from the release of noble gases from reprocessing plants (particularly Kr-85) is the dose commitment (man-rem) delivered to populations. Over the period 1980-2000, the United States would contribute approximately 25% of the Kr-85 dose commitment to the world population. Thus, if the United States were the sole nation to require noble gas removal from reprocessing plant effluents, the desired consequences of control would be largely negated. Similarly, the costs associated with reductions in dose commitments may be related to both the United States population and that of the world. Estimates of these costs are provided in Table IV.

TABLE IV. COST ESTIMATES PER MAN-REM REDUCTION OF KR-85 DOSE COMMITMENT FROM U.S. LWR REPROCESSING PLANTS

Year	No. of Plants[1]	Cost in Dollars Per Man-Rem Reduction[2] U.S. Population Holdup	U.S. Population Holdup and BF[3]	World Population Holdup	World Population Holdup and BF[3]
1975	0				
1980	0				
1985	2	29,800	36,500	352	393
1990	4	19,900	26,500	228	277
1995	8	20,400	25,000	224	249
2000	11	19,700	23,500	204	222

1. In addition to NFS, AGNS, and MFRD plants.
2. In dollars of 1973.
3. Plants built prior to 1983 backfitted (BF) to recover 99% of the krypton in the fuel received.

As may be seen in Table IV, the costs per man-rem reduction in dose to the population of the United States is about a factor of 90 greater than that to the worldwide population. An interim value of $1,000 per man-rem and $1,000 per man-thyroid-rem are specified in Appendix [illegible] for judging the cost effectiveness of efforts to reduce population doses. Kr-85 removal equipment installation and operation would not be cost-effective when considering the U.S. population dose from Kr-85. Only in terms of world population can the installation of Kr-85 removal systems be argued as justifiable in terms of cost effectiveness. Unilateral action on the part of the United States to remove Kr-85 would have little effect on the dose delivered to the entire world population. Foreign fuel processing will contribute about 3 times the Kr-85 dose contributed by processing in the United States if Kr-85 is not collected by any country. Given these considerations, it is the view of the staff that the self-imposition by 1983 of Kr-85 removal systems upon United States fuel reprocessing plants should be deferred pending resolution of developing standards now in progress under auspices of the International Atomic Energy Agency.

A delay in imposing standards for Kr-85 release for the purpose of establishing policy will impose virtually no added risk to any individual. Estimated dose rates as a result of assumed releases from all worldwide facilities of Kr-85 through the year 2000 are about 0.03 mrem whole body per year or about 1/2500 that of natural background radiation.[17] Skin dose rates for such conditions are calculated to be about 3 mrem per year.

Prior to the imposition of release standards for Kr-85 with the consequent investments in equipment and operations, the staff believes that these costs should be examined in terms of societal risks and alternative beneficial investments of the nation's resources. This view is in consonance with a conclusion given in the BEIR report[18] that states "... it is becoming increasingly important that society not expend enormously large resources to reduce very small risks still further, at the expense of greater risks that go unattended; such unbalances may pass unnoticed unless a cost-benefit analysis is attempted. If these matters are not explored, the decisions will still be made and the complex issues resolved either arbitrarily or by default since the setting and implementation of standards represent such a resolution."

While the above considerations appear to be overriding, the development of krypton removal equipment to practice in fuel reprocessing plants should be fostered and continued, particularly in view of the possibility of international agreements to limit releases of Kr-85. The staff also notes that the unilateral requirement of restricted Kr-85 release by the U.S. could also adversely affect the competitive position of the U.S. in processing fuel compared to that of foreign countries which do not have such a requirement.

It is expected that noble gas removal systems appropriate to the fuel reprocessing industry could be operational in 1983 if appropriate research and development efforts were to be initiated now.[8] This date, when compliance with the EPA Kr-85 release standards is proposed, may be optimistic.

However, the EPA proposes that the development program on noble gas removal be reviewed in the future to establish the practicability of removal systems prior to 1983. At present, two noble gas removal systems appear to have the greatest promise. These systems may be described as the selective absorption and the cryogenic distillation systems. Description of these systems and estimated schedules for their proof of practice certifications are provided in References 17 through 26.

9. Utility of the EPA Proposed Standard

In 1971, the AEC amended 10 CFR Parts 20 and 50 to include the following criteria:

10 CFR Part 20.1(c)

> "... persons engaged in activities under licenses ... should, in addition to complying with the requirements set forth in [10 CFR Part 20] ... make every reasonable effort to maintain radiation exposures and releases of radioactive material in effluents to unrestricted areas as far below the limits specified in [10 CFR Part 20] as practicable."

10 CFR Part 50.34a(a)

> "... The applicant [for a permit to construct a nuclear power reactor] shall ... identify the design objectives, and the means to be employed, for keeping levels of radioactive material in effluents to unrestricted areas as low as practicable."

The terminology "as low as practicable" is defined in 10 CFR Parts 20 and 50 to be:

> "... as low as is practicably achievable taking into account the state of technology and the economics of improvements in relation to the benefits to the health and safety and in relation to the utilization of atomic energy in the public interest."

In 1971 the AEC proposed numerical guidelines for radioactive material in LWR effluents to meet the criterion "as low as practicable." An evidentiary public hearing was held on the rulemaking action. About 4,200 pages of testimony, a three-volume environmental impact statement, and thousands of pages of written testimony and exhibits were produced in this rulemaking action. The public hearing was completed on December 6, 1973, and the NRC published Appendix I as an amendment to 10 CFR Part 50 on May 5, 1975. While the rulemaking action was time consuming and extensive, it permitted participation by all interested parties and was responsible for the development of a substantial data base upon which a sound rule could be drawn. Further, the criterion "as low as practicable" which exists in 10 CFR Parts 20 and 50 was applied in the licensing of reactors in an effective manner during the four-year period that was required to complete the rulemaking process.

Upon completion of the public hearing on Appendix I, an effort was initiated to develop the generic technical and economic data base for selection of numerical guides to meet the "as low as practicable" criterion for uranium fuel cycle facilities other than LWR power stations. While a substantial amount of data has been produced from this effort, the generic effort has not been completed and the numerical guidelines for all uranium fuel cycle facilities are specified on a case-by-case basis in the licensing review.

In view of the effective effort demonstrated by the NRC to restrict exposures and releases of radioactive material from licensed nuclear facilities to as low as reasonably achievable levels, it appears that the proposed EPA 40 CFR Part 190 would not significantly reduce the population exposure from reactor and fuel cycle effluents, but it does have significant administrative impacts in other areas as described below.

10. Implementation of the EPA Proposed Standard

Among the alternatives to 40 CFR Part 190 considered by EPA was one which would set lower values for the standard. This alternative was rejected by EPA because, as stated in the EPA DES, "... it would impose a large administrative burden on NRC in order to insure compliance."
Should the proposed 40 CFR Part 190 become an effective rule, implementation of that rule would impose a substantial administrative burden. The following technically substantive administrative problems are representative of those which would be presented to NRC if 40 CFR Part 190 were to become a rule.

a. Revise 10 CFR Part 20 and the recently amended Part 50 (Appendix I) to implement 40 CFR Part 190.

b. Revise Technical Specifications for all licensed LWR power stations to reflect the requirements of 40 CFR Part 190.

c. Review all licensing actions to identify facilities which will require additional radwaste treatment or other features which will permit compliance with 40 CFR Part 190 and identify methods by which compliance could be accomplished and demonstrated.

d. Decide, as a matter of policy, whether the facilities should be designed for current land and water usage by persons in the near vicinity of the station and require backfit or restrictions should usage change, or design for potential land and water usage to avoid the more costly backfitting, operating restrictions, and extensive surveillance requirements.

e. Determine whether the quantities of Kr-85 and I-129 which would be permitted by 40 CFR Part 190 after January 1, 1983, refer to all uranium fuel processed after that date or only to that fuel which was used to generate electrical power after that date. A finding on this issue could influence decisions on matters such as the schedule for processing spent fuel and similar issues dealing with fuel and waste management.

f. Provide guidelines on what constitutes "a temporary and unusual operating condition" for a nuclear facility for which the NRC may grant a "variance." Guidelines also would have to be provided for judging the "necessity to protect the overall societal interest with respect to the orderly delivery of electrical power" should the need for a variance by NRC be required for a uranium fuel cycle facility.

g. Review the analytical models currently used by NRC staff to estimate potential doses and consider possible modifications or adjustments for doses to "real people" as stated by the EPA in the DES. It is actually impossible to determine accurately the actual doses to specific individuals owing to the mulviple exposure modes, the levels which are too low to measure, the mobility of individuals, unique characteristics of individuals, and other factors.

h. Perform studies to determine the relationships between releases of radioactive material and the doses which might be received by individuals in a region where interactions of dispersion patterns from multiple nuclear facilities overlap.

i. Determine what modifications on siting criteria for uranium fuel cycle facilities might be required to comply with 40 CFR Part 190. In view of the low dose limits specified in the EPA proposed standard, distance requirements required to assure compliance for normal operations of the facilities might be more restrictive than those required in consideration of serious accident situations.

j. Devise a system for relating release quantities of Kr-85, I-129, and long-lived transuranic elements to the power generated by LWR power stations and allocating permissible release quantities among uranium fuel cycle facilities. Allocation of release quantities among newer and older facilities would be complicated by factors such as possible competitive advantages which might be realized by older stations, which might not have features which will be included in new facilities, should they be granted release allotments based on considerations other than fuel burnup quantities. On the other hand, backfitting of older facilities can be extremely expensive and place these facilities at a competitive disadvantage if the backfitting is required.

If the contributions of the iodine-129 and alpha-emitting transuranics from light-water-cooled nuclear reactors would have to be assessed in order to comply with the proposed standards, then a considerable expenditure of effort

and money would be required to measure radionuclides which, in themselves, contribute insignificantly to the radiation dose from nuclear power reactors. If the reactor contribution could be omitted, then the standards would represent effluent limitations solely for spent fuel reprocessing plants.

Even if the contributions from the reactor facilities were omitted, determination of a priori effluent limitations (such as the technical specifications in NRC licensing conditions) would prove almost impossible. Because these proposed limits are tied to energy production, knowledge of the fuel burnup and the thermal efficiency of the reactor (to convert thermal energy to electrical energy) would be required for each batch of fuel reprocessed. Because of the variation in individual reactor designs, power level, and fuel management practices, it would be nearly impossible to specify, beforehand, the total equivalent energy generated by the annual reprocessing plant throughput of spent fuel. The reprocessing facility would have to keep a running account of the total activity released to the environment and the total energy which had been generated by the fuel. The ratio of these quantities would have to be computed prior to initiation of processing for each batch of fuel in order to determine whether that batch could be processed without exceeding the EPA standard. Even if a given reprocessing plant were to remain in compliance, the ratio of the total activity discharged and the total equivalent energy production for all reprocessing facilities would have to be calculated by NRC for every batch of fuel reprocessed to insure that the overall totals were in compliance.

II. Perspective of the Impact of the EPA Proposed Standard

The EPA Draft Environmental Impact Statement (DES)* states that implementation of the proposed 40 CFR Part 190 would avert an estimated 1030 "potential health effects" which would occur if current NRC regulatory practices were to continue. The DES presents values for the potential health effects attributable to operation of the nuclear fuel cycle through the year 2000 at various environmental radiation protection levels. Table 10 on page 82 of the DES contains columns which contain estimated values based on existing "Federal Radiation Guides," "Current AEC Practice," and "EPA Generally Applicable Standards." According to this table, there would be a substantial difference between the values projected under FRC guidance and AEC practice only for short-lived materials where Appendix I has been recognized to restrict releases in effluents to levels below the FRC guides. The values projected under FRC guidance and AEC practice are identical for all other sources. The DES does not present sufficient details to determine the bases for the estimates presented, but apparently the estimates do not recognize that the nuclear facilities have not been operated in a manner which would result in doses to individuals at levels as high as those permitted by the FRC standards nor does it recognize the existence of the "as low as reasonably achievable" criterion which the NRC applies to all uranium fuel cycle facilities and which assures that the dose levels are well below the FRC guides.

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*Table 10, page 82, DES

In addition, the potential health effects are estimated assuming a linear nonthreshold relationship of somatic and genetic effects to radiation dose at levels which approach zero and which are delivered at a very low dose rate. The bulk of the health effects are postulated to occur as a result of integrating the extremely low doses from long-lived materials to the world's population over several decades.**

Without a perspective, the estimated 1030 health effects postulated to occur over about 150 years might appear to be substantive. Placed in perspective, the estimated 1030 health effects are small, a small number in a statistical sense when compared to the billions of such health effects which can be estimated to occur from other causes during the same time period. Table V presents an estimate of the normal incidence of cancer and serious genetic diseases of the types referred to as "health effects."

Numerical estimates of "health effects" presented in the Draft Environmental Impact Statement for the Uranium Fuel Cycle standard are based upon the hypothesis of a linear, non-threshold, dose rate independent relationship between biological effects and doses applied at levels which approach natural backgsound. This is consistent with the recommendations of scientific authorities in matters of radiation protection. However, experimental data are inadequate to verify or to

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**Table 3, page 12, Environmental Analysis of the Uranium Fuel Cycle, Part III, Nuclear Fuel Reprocessing, EPA-520/9-73-003D, Oct. 1973 deny this hypothesis. An alternate hypothesis is that the probability of biological effects are reduced when the doses are delivered at low dose rates and that an effective threshold exists. If this alternate hypothesis is correct, the probability of biological effects at very low dose levels could be zero. More than 93% of the total-body dose commitment, which represent essentially all of the calculated health effects, are the result of summing doses far less than one mrem per year to the entire population of the world over several decades. Thus, a fair statement would be that the expected impact is likely to be within the range from zero to 1030 health effects.

TABLE V. ESTIMATED NORMAL INCIDENCE OF "HEALTH EFFECTS" IN THE U.S. AND IN THE WORLD

Period	Population	Cancer	Genetic
1970-2020[1]	U.S.[2]	$1.8x10^7$ deaths[3]	--
		$3.7x10^7$ cases[4]	--
1970-2120[5]	U.S.	--	$5.0x10^7$ cases[6]
1970-2020	World[7]	$5.9x10^8$ deaths[8]	--
		$1.2x10^9$ cases	--
1970-2120	World	--	$3.0x10^9$ cases[9]

Total health effects (cancer + genetic) cases

U.S.	$8.6x10^7$ cases
World	$4.2x10^9$ cases

1/ A 50-year period was selected for evaluating cancer incidence to compare with the EPA postulated number of somatic effects resulting from doses from exposures to radiation originating in U-fuel cycle facilities during the several decades.

2/ The population of the U.S. was based on Fig. D.1, p. D-9 of EPA-520/9-73-003D.

3/ A cancer death rate of $1.29x10^{-3}$ per person year from the U.S. was selected from World Health Statistics Annual 1966-67.

4/ The number of new cancer cases was assumed to be twice the number of cancer deaths per the NAS/NRC BEIR Report.

5/ A 150-year period was selected for evaluating genetic disease incidence to correspond to the time period for the EPA genetic estimates.

6/ A value of 6% was selected for genetic disease incidence based on estimates in the BEIR Report.

7/ The world population was assumed to be $3.5x10^9$ in 1970 and to increase by 1.9% per year to be consistent with p D-15 of EPA-520/9-73-003D.

8/ A calcer death rate of $1.22x10^{-3}$ per person year for the world was estimated from data in the World Health Statistics Annual 1966-67.

9/ The U.S. genetic disease incidence (6%) was assumed to apply the world population.

Further, the United States will contribute only about one-quarter of the Kr-85 worldwide inventory from uranium fuel cycle operations which will be the source of these worldwide low-level doses. Neither national nor international authorities in radiation protection have specifically addressed the significance of worldwide low-level doses and the need for international control of Kr-85 and similar radioactive sources.

While the values for normal incidence presented in Table VII are gross estimates, it is clear that the estimated 1030 health effects which EPA postulates to be averted by implementing the proposed 40 CFR Part 190, even if correct, would cost about $100,000,000 to the United States and would represent an increase of less than 0.0003% in the normal incidence of these health effects.

1. Lowder, W. M. and Raft, P. D., "Environmental Gamma Radiation Exposure Rates from Nitrogen-16 in the Turbines of a Large BWR Power Plant," Health and Safety Laboratory, USAEC, New York, October 1971.

2. Lowder, W. M., Raft, P. D., and Gogolak, C. V., "Environmental Gamma Radiation from Nitrogen-16 Decay in the Turbines of a Large Boiling Water Reactor," Health and Safety Laboratory, HASL TM 72-1, USAEC, New York, February 1972.

3. Lowder, W. M., Raft, P. D., and Gogolak, C. V., "Environmental Gamma Radiation from Nitrogen-16 Decay in the Turbines of a Large Boiling Water Reactor," Health and Safety Laboratory, HASL-271, USAEC, New York, January 1973.

4. Hairr, L. M., LeClare, P.C., Philbin, T.W., and Tuday, J.R., "The Evaluation of Direct Radiation in the Vicinity of Nuclear Power Stations," Environmental Analysts, Inc., Garden City, N.Y., Publication No. 303, June 1973.

5. Memorandum to Participants in the April N-16 Radiation Surveys at the Arnold and Cooper Nuclear Power Stations, W. M. Lowder, ERDA/HASL, June 11, 1975 (and attachments).

6. Private Communication, James M. Smith, Jr., Nuclear Energy Division, General Electric Company, San Jose, California, to William E. Kreger, USAEC, January 17, 1975.

7. Private Communication, E. A. Warman, Stone and Webster Engineering Corporation, to J. Kastner, USAEC.

8. Blanco, R. E., et al, Correlation of Radioactive Waste Treatment Costs and Environmental Impact of Waste Effluents in the Nuclear Fuel Cycle for Use in Establishing "As Low As Practicable" Guides - Nuclear Fuel Reprocessing, ORNL-TM-4901, in press.

9. "Supplemental Testimony Regarding the Health Effect to the Local Population from Normal Operations of the Barnwell Nuclear Fuel Plant (The Reprocessing Facility)," F. J. Congel and K. F. Eckerman, Docket No. 50-332, undated.

10. Statistical Data of the Uranium Industry, U.S. Atomic Energy Commission, p 62, 1974.

11. Merritt, Robert C., The Extractive Metallurgy of Uranium, Colorado School of Mines Research Institute, 1971.

12. HASL Technical Memorandum, 64-14, July 31, 1964.

13. Evaluation of Radon-222 Near Uranium Tailing Piles, U.S. Public Health Service, DER 69-1, March 1969.

14. "Disposition and Control of Uranium Mill Tailings Piles in the Colorado River Basin," Federal Water Pollution Control Administration, Region VIII, U. S. Department of Health, Education and Welfare, Denver, March 1966.

15. Environmental Statements for Highland Uranium Mill (Docket No. 40-8102), the Shirley Basin Uranium Mill (Docket No. 40-6622), and the Humeca Mill (Docket No. 40-8084) and the Environmental Impact Appraisal for the Petrotomics Co. Uranium Mill (Docket No. 40-6659).

16. Blanco, R. E., et al, Correlation of Radioactive Waste Treatment Costs and Environmental Impact of Waste Effluents in the Nuclear Fuel Cycle for Use in Establishing "As Low As Practicable" Guides - Uranium Milling, ORNL-TM-4903, in press.

17. "The Potential Radiological Implications of Nuclear Facilities in the Upper Mississippi River Basin in the Year 2000," USAEC, WASH-1209, January 1973.

18. "The Effects on Population of Exposure to Low Levels of Ionizing Radiation," Report of the Advisory Committee on the Biological Effects of Ionizing Radiations, Division of Medical Sciences, National Academy of Sciences National Research Council, Washington, D.C., November 1972.

19. Stephenson, M. J., et al, "Experimental Demonstration of the Selective Absorption Process for Krypton-Xenon Removal," Proceedings of the 12th Air Cleaning Conference Held in Oak Ridge, Tennessee, August 28-31, 1972, CONF-720823, Vol. 1, January 1973.

20, Hogg, R. M., "New Radwaste Retention System," Nuclear Engineering International 17, 98-99, 1972.

21. Nichols, J. P. and Binford, F. T., "Status of Noble Gas Removal and Disposal," ORNL-TM-3515, August 1971.

22. Bendixsen, C. L. and Offutt, G. F., "Rare Gas Recovery Facility at the Idaho Chemical Processing Plant," IN-1221, April 1969.

23. Bendixsen, C. L. and Rohde, K. L., "Operational Performance and Safety of a Cryogenic System for Krypton Recovery," Trans. Am. Nucl. Soc., 15(1), 96, 1972.

24. Davis, J. S. and Martin, J. R., "A Cryogenic Approach to Fuel Reprocessing Gaseous Radwaste Treatment," Trans. Am. Nucl. Soc., 16, 176-77, 1973.

25. Draft Environmental Statement, Limerick Generating Station, Dockets 50-352 and 50-353.

26. Draft Environmental Statement, Susquehanna Steam Electric Station, Dockets 50-387 and 50-388.

APPENDIX A

CALCULATED ^{16}N TURBINE DOSES

Measurements at several boiling water reactors[1-5] have shown that the dose rate from direct radiation falls off exponentially with distance according to the formula:

$$D(r) = Ae^{-br}$$

where D(r) is the dose rate at distance r in mrem/year, r is the distance from the turbine in meters, and A and b are parameters which are determined by fitting the model to experimental data. These constants are highly dependent upon the turbine building design and the reactor power level as shown in Table A-1. At present, these variations are not well understood. The parameters generally represent the dependence of the dose rate upon distance in the direction of the highest measured dose. The dose rate is also related to the direction with respect to the turbine axis so that the doses calculated using those parameters represent upper bound estimates. The exponential nature of the model indicates that the dose rates fall off rapidly with distance.

TABLE A-1

EXTERNAL DOSE PARAMETERS DETERMINED FROM EXPERIMENTAL MEASUREMENTS[1-5]

Code	Reactor Power Level MWe	A	b
1	600	1250	0.0132
2	1840	716	0.0088
3	1555	543	0.0091
4	1000 (normalized)	108	0.011
5	1000 (normalized)	125	0.0066
6	1000 (normalized)	858	0.0099
7	1000 (normalized)	2470	0.0161

In order to estimate the doses which may exist at typical reactor sites, the site boundary (exclusion radius) distance and the distance to the nearest residence were examined for 13 BWR reactors selected at random. These distances were measured from the reactor building and not the turbine axis, but they give approximate estimates of the distances which could represent actual site conditions for real reactor installations. The range of values is represented in Table A-2.

TABLE A-2

REPRESENTATIVE BWR SITE PARAMETERS

	Minimum	Maximum	Average I S. E.
Site Boundary (meters)	215	1340	650 ± 110
Nearest Residence (meters)	430	1560	925 ± 115

These distances were used with the models in Table A-1 to determine the range of doses which might be expected to occur at real sites and distances. The results of these calculations are shown in Table A-3. As can be seen, the majority of the calculations yield doses which are considerably below 1 mrem/year. However, for smaller sites the contributions to the external dose rate could be appreciable fractions of the proposed EPA standard. The site boundary doses assume continuous occupancy which would not actually occur, but even with a 10% occupancy (880 hours per year)

the site boundary doses at the smallest site might be 7 - 10 mrem/year. These doses could be additive to the dose contribution from radioactive materials in the facility effluents and could, thereby, result in total doses in excess of the proposed standard of 25 mrem/year. Because the turbine doses are highly dependent upon individual site and reactor design parameters, the NRC staff believes that they can be more properly addressed in individual licensing actions on a case-by-case basis, rather than by a general standard.

TABLE A-3

CALCULATED DIRECT RADIATION DOSES FROM BWR TURBINES

Location	Distance (m)	Model	Calculated Dose Rate (mrem/year) 1	2	3	4	5	6	7	Average
Site Boundary	215	minimum	73*	108*	7*	10*	30*	102*	78*	68*
	1340	maximum	<0.0001	0.0056	0.0026	<0.0001	0.018	0.0015	<0.0001	0.0039
	650	average	0.23	2.4	1.4	0.085	1.7	1.4	0.07	1.0
Nearest Residence	433	minimum	4.0	16	10	0.92	7.2	12	2.3	7.5
	1560	maximum	<0.0001	0.0008	0.0003	<0.0001	0.004	0.0002	<0.0001	0.0008
	925	average	0.006	0.21	0.12	0.0041	0.28	0.090	0.0008	0.10

*hypothetical doses based upon continuous occupancy

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

SEP 25 1975

Honorable Russell E. Train
Environmental Protection Agency

Dear Mr. Train:

We have reviewed the proposed EPA Regulation (40 CFR, Part 190) on Environmental Radiation Protection for Nuclear Power Operations and the supporting Draft Environmental Impact Statement (DEIS). We find that the proposed environmental radiation standards are not justified on the basis of the estimates of health effects, costs, as derived in the DEIS, and the risk benefit analysis presented in support of the proposed standards. It is our concern that the proposed regulation would establish environmental radiation limits for the entire uranium fuel cycle, at levels which are a small fraction (as low as 5 percent) of the established international, national, and Federal radiation standards, without compelling evidence that the imposition of such limitations on this Nation's nuclear power economy is technically and economically justified, or cost-effective.

The health effects estimates, which are the basis for the proposed regulations, are derived by linear extrapolation from effects at high radiation doses and dose rates, i.e., the linear dose-effect assumption. While such an assumption is of value in estimating the upper limit of the potential for effects from low levels of exposure to radiation, or other potentially harmful agents, it is widely recognized that the assumption must be interpreted prudently and with appropriate qualifications since in all probability it overestimates the actual risk. Both the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) warn against the use of this deliberately cautious assumption in estimating actual effects in their respective reports on this subject (ICRP Publication 22 and NCRP Report No. 43).

Use of the linear assumption also distorts the assessments of costs and benefits by exaggerating the number of effects to which the costs are ascribed and consequently the benefit derived from a reduction in dose. The details and sources of the cost information presented in the DEIS are not provided and, therefore, cannot be specifically evaluated, though they do not appear to be realistic. This is particularly true with respect to the cost of krypton removal, to be required in 1983. Since the removal technology has not been developed, actual or realistic estimates of cost are not possible at this time. The relative risks and costs of storing large quantities of krypton compared to the routine release of low concentrations have not yet been evaluated. Valid cost-benefit analysis of this aspect is not yet possible and should await further development of the removal technology.

Careful deliberation of the justification for and implications of the proposed changes in the approach to establishing environmental radiation standards is warranted. In the meantime, implementation of NRC Regulation 10 CFR, Part 50, Appendix I, requiring installation of the best available effluent control technology, will assure that public exposures due to effluents from normal operation of the uranium fuel cycle will be controlled to levels comparable to those in the proposed EPA regulation. There is, therefore, ample time for careful consideration of the justification for and impact of any proposed changes in the environmental radiation standards.

Firm technical and economic justification in support of the proposed fuel cycle standards is lacking. The enclosed staff comments re-emphasize the uncertainties expressed in the estimates of health effects, in the cost-benefit analysis, and in other significant technical areas offered in support of the proposed regulation. The substantial economic impact of these very stringent standards on the production of nuclear energy in the United States demands that the justification for the proposed action be thoroughly examined in detail to make certain it is soundly justified. This agency will be happy to assist in any way we can in this regard. Toward this end we will want to participate in the planned public hearings on the proposed regulations.

Sincerely,

Hal Hollister

for James L. Liverman
Assistant Administrator
for Environment and Safety

Enclosure:
Staff Comments on Proposed
Regulation and DEIS

cc: Council on Environmental
Quality (5 copies)

STAFF COMMENTS ON PROPOSED EPA REGULATION (40 CFR PART 190) "ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR NUCLEAR POWER OPERATIONS" AND ACCOMPANYING DRAFT ENVIRONMENTAL IMPACT STATEMENT

General

The proposed EPA regulation would prescribe environmental radiation standards for the uranium fuel cycle at levels far below the internationally and nationally established standards, on the basis of a cost-benefit analysis of the potential risk of radiation effects and the capabilities of control technology that EPA deems to be practicable. Assuming that this is an appropriate basis for developing such standards, neither the technical justification for the numerical standards being proposed nor their cost-effectiveness are substantiated by the information presented in the "Notice of Proposed Rulemaking" or the Draft Environmental Impact Statement (DEIS) supporting the proposed rule. Also, it is our understanding that any such standards should adequately reflect the findings of the Nuclear Regulatory Commission as to the practicability of effluent controls.

The proposed rulemaking represents a substantial departure from the philosophy and specific recommendations of the international and national organizations (ICRP, NCRP, and FRC) by proposing firm, enforceable limits (including requirements for a variance to exceed the levels for "temporary and unusual operating conditions"), at levels which are a small fraction (as little as 5 percent) of the values established by the ICRP, NCRP and FRC as guides. Also, the establishment of firm limits at these very low levels, based on the conservative linear dose-effect assumption, is inconsistent with the recent admonishments of both the ICRP in Publication 22 and the NCRP in Report No. 43. It is their conclusion that the use of the linear dose-effect assumption cannot be expected to provide realistic estimates of the actual risks, may thus overestimate the benefits of dose reductions, and is "... of only marginal value, if any, for purposes of making realistic risk-benefit evaluations."

Implementation and enforcement of the proposed standards will entail technical and administrative burdens and costs which are not addressed in the proposed rule or supporting DEIS and are not reflected in the evaluation of cost-effectiveness. It is not possible to accurately measure the potential exposure of "any member of the public" at these low dose levels which are small by comparison with natural variations in background. The difficulties of measurement to determine compliance would be complicated by the fact that the regulatory controls imposed by NRC on individual facilities will have to include a margin of safety to assure compliance with the proposed generally applicable standards. In addition, the individual facility will impose its own more stringent operating limits to assure compliance with the NRC regulatory controls.

The proposed standards are not consistent with the intent of the December 7, 1973, Ash memorandum "Responsibility for Setting Radiation Protection Standards." Contrary to the specific instructions and general intent of the Ash memorandum regarding the establishment of "generally applicable environmental radiation standards" the proposed curie limitations on krypton and iodine discharges to the environment would impose limits on discharges from fuel reprocessing facilities.

THE PROPOSED STANDARDS

1. Analysis of Cost Effectiveness.

The proposed standards and their cost-effectiveness are not supported by the data and information in the DEIS prepared in support of the proposed rule. The proposed maximum allowable annual dose limits appear to be based on an analysis of the best performance capability of fuel cycle facilities rather than on a cost-benefit evaluation. Setting enforceable, numerical upper limits close to the levels attainable in practice is likely not to be cost-effective since the reduction in potential health consequences, if any, will be very small and additional costs for enforcement and monitoring to determine compliance could be considerable. In addition, the proposed standards would not insure that overall radiation risk is minimized since the occupational dose may increase because reductions of population dose require increased inplant containment and handling of radioactive materials. Thus the presentation of a thorough cost analysis in the DEIS is of critical importance. The need for such an analysis is clearly stated in the report of the Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR):

> "Furthermore, it is becoming increasingly important that society not expend enormously large resources to reduce very small risks still further, at the expense of greater risks that go unattended; such imbalances may pass unnoticed unless a cost-benefit analysis is attempted."

The importance of realistic values has also been emphasized by the NCRP in Report No. 43:

> "Before considering any further restriction of radiation protection standards, it is important to attain realistic values for risks and benefits, for weighing risks and benefits in decision-making and for the most effective application of the principle of 'lowest practicable level.' This approach is important in order to avoid the expenditure of large amounts of the limited resources of society to reduce very small risks still further with possible concomitant increase in risks of other hazards or consequent lack of attention to existing greater risks."

2. Health Effects Evaluation.

The discussion of health effects at these low levels conveys a degree of hazard and concern which is inconsistent with ICRP and NCRP guidance. The proposed standards are not given proper perspective with respect to ICRP and NCRP guidance particularly with regard to their relative health effects. As stated by the ICRP in Publication 22, "At low levels of individual dose, e.g., those small by comparison with variations in local natural background, the risk to the individual is so small that his health and welfare will not be significantly changed by the presence or absence of the radiation dose." The NCRP, in Report No. 43, has stated that "At such low radiation levels as are involved in the radiation protection standards, identification and quantification of both risks and benefits are so highly uncertain and imprecise at this time that the practice of balancing risks and benefits numerically is not useful to pursue without far more thorough and penetrating exploration."

3. Determination of Maximum Annual Dose.

The limitation on the maximum annual dose to "... any person in the public ..." (underscoring added) is a substantial departure from FRC, NCRP and ICRP philosophy. Implementation of this requirement could be a source of serious difficulty due to the inability and impracticability of measuring the dose to each individual. The heavy emphasis placed on the dose to the individual member of the public is also difficult to understand in light of the very low order (zero to 10^{-5}) of estimated risk to the individual receiving a few tens of mrems per year from fuel cycle operations and considering the statement by the ICRP in Publication 22, quoted above.

4. Adequacy of Current Standards.

Since analyses presented in "Environmental Radiation Dose Commitment: An Application to the Power Industry" (EPA, 1974) and similar studies indicate that effluents from nuclear fuel cycle operations conducted under existing standards and regulatory procedures result in a very small risk to public health, there appears to be no compelling reason to revise established standards prior to completion of adequate studies of cost-effectiveness. In addition, the proposed standards, particularly the curie limits, may require substantial facility modification as design and operating experience provide information required for assessing the cost-effectiveness of control technology alternatives now under development. Assuming the technology is developed and proves successful in meeting the proposed requirements within the next 3-5 years, it is doubtful that a unit could be designed, installed, and brought to reliable operating status before the required date. Again, it is to be noted that the Ash memorandum stated that EPA standards "would have to reflect AEC's (now NRC's) findings as to the practicability of emission controls," a condition that cannot be met until removal technology is adequately demonstrated on an operating facility.

5. Application of Proposed Rulemaking.

With regard to 190.10a, it is not clear whether or not these dose standards are intended to be per gigawatt-year of electrical energy produced by the fuel cycle. It is clearly stated that the curie limits do apply per gigawatt-year of energy. If it is not applied to the dose standards, some explanation is in order.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

1. Justification for the Proposed Course of Action:

It is stated categorically that the proposed standards are estimated to reduce the potential health impact of the uranium fuel cycle by greater than 1,000 cases of cancer, leukemia and serious genetic defects. Presumably this value assumes maximum exposure at both current and proposed exposure standards, and is derived on the basis of relating source terms, release rates, environmental dispersion, dose equivalent determinations, dose-response relationships and the calculation of benefit, cost and risk. While the justification for, verification of, references to and calculations relating to all of these variables are not present, the final value is given. However, it is seen from Table 10, page 82, that under the proposed regulations the overwhelming cause of potential health effects is due to tritium and to carbon-14 particularly. It is also seen from this table that the proposed standards in no way apply to either of these radioisotopes. The reason for this judgment is given on pages 68, 81 and 93. Briefly stated, the lack of standards for tritium and for ^{14}C is justified on the basis that "control technologies for these materials are not yet commercially available" (page 91). Therefore, limits apparently were chosen on the basis of what can readily be met by present and proven technology. This feature is clear not only with regard to carbon-14 and tritium, for which no standards are set, since control technology is not adequate to meet any particular standards, but also with regard to krypton-85 and iodine-129, where standards will become effective in 1983, at which time new control systems are expected to become available. However, since tritium and carbon-14 contribute by far the greatest part of the potential health effects, this would seem to question whether the proposed standards are in fact based upon some upper level of risk from which the public must be shielded or whether the proposed standards are in fact based upon "technologies ... commercially available."

2. Content and Format of the DEIS.

In several areas the DEIS does not comply with NEPA-CEQ guidelines for content or organization outlined in 40 CFR Chapter 1, Part 6, subpart C. It does not fully treat known responsible opposing views, or all potential adverse effects; it omits relevant alternative courses of action, a cost-benefit analysis, and discussion of short-term uses versus long-term productivity; and it does not treat irreversible and irretrievable commitments of resources.

A. Discussion of Opposing Views

Over the past several years there have been a number of proposals to revise the present internationally accepted radiation exposure standards by defining "as low as practicable" exposures in quantitative terms, using the linear dose-effect theory as a rationale. These proposals have been highly controversial, but the DEIS does not discuss them. The opinions and cautions of the NCRP are not acknowledged or referred to. This has contributed to a continuing concern of many professional radiation protection specialists that the EPA is seemingly indifferent to the evaluations and recommendations of independent and recognized authoritative entities in this field with whom the EPA might have differences of opinion.

It is important to note that other countries have not seen the need to take action similar to the proposed rulemaking. The levels of specific control proposed apparently do not take into account the inverse question of releases of persistent nuclides which may take place in the future from sources outside the U.S. (as nuclear power grows worldwide) and which (through long-term pathway processes) may therefore have an effect upon the eventual buildups experienced in the U.S. and hence upon the releases to be permitted for

U.S. facilities now. The views of the Department of State should be solicited on the subject of unilateral U.S. action drastically departing from accepted international standards in view of the increased attention international organizations are giving to the quality of the worldwide environment.

B. Potential Adverse Effects

There are several ways in which the proposed action may have an adverse environmental effect. One would be the discouragement and reduction of the use of nuclear power, because of the high costs of any added control requirements and other factors. This could lead to the generation of power by alternative systems which may have increased detrimental environmental effects.

Another possible adverse environmental effect could be the placing of a disproportionate attention on environmental radiation to the exclusion of attention to some other aspect of safety and environmental protection. For example, no discussion is given of management of the ^{85}Kr and ^{129}I captured in the collection devices used to limit effluent releases. If this collection is considered part of waste management, not considered in this statement, the relationship should be made clear. The environmental impact of collecting the noble gases rather than releasing them at the reprocessing plant (storage facility requirements, accident potential, etc.) and increased doses to fuel cycle workers (and resulting effects) should be addressed.

Although the proposed limits on maximum radiation exposures to individuals are very probably attainable for single facility sites, they may be difficult for multi-facility sites or nuclear parks to meet. It is argued that because current plans do not envisage energy parks in operation over the next decade, these parks need not be considered. However, the proposed limits may discourage plans for energy parks for the following decades. Since the energy parks may well offer reduced overall radiation and health effects to the general public (at the expense of slightly higher individual exposures) along with possible cost savings and safeguards improvements, the long range implications of the standards on the parks should be explicitly addressed.

An extremely important portion of the uranium fuel cycle, transportation, was barely mentioned. It is suggested that the

individual and population doses to workers and the general public due to transportation for the uranium fuel cycle be estimated and the effect of the proposed EPA standards on these should be discussed.

C. Discussion of Alternative Courses of Action

In particular, the alternative of no additional standards has not been fully treated. Stated objectives for the development of the proposed standards (cost-effectiveness and as low as practicable) are the same as those NRC has developed in its own rulemaking efforts for the uranium fuel cycle. Since both agencies appear to be working toward the same ends, the environmental statement should clearly establish the extent of duplicity and the need, if any, for this EPA rulemaking effort. Justification for the alternative chosen is very weak in light of the fact that the DEIS does not indicate any deficiencies in the NRC regulatory program which has caused or would cause that program to fall short of providing adequate protection for the public and the environment or attainment of as low as practicable conditions on a timely basis.

D. Cost Benefit Analysis

Heavy emphasis is placed on cost-benefit analysis as a basis for specific implementation of existing standards and guidelines for controlling radiation exposure. We strongly support this philosophy but find that contrary to the strong implication in the DEIS and proposed rulemaking, there is little or no basis for judging the cost-effectiveness of the proposed rule.

The proposed maximum allowable annual dose limits appear to be based not on an analysis of cost-effectiveness but on the performance capability of fuel cycle facilities to date. Setting enforceable, numerical upper limits close to those achieved in practice under current standards is likely not to be cost-effective since the reduction in potential health consequences, if any, will be very small and additional costs for enforcement and monitoring would be considerable. The "cost-effective" approach appears to be very sensitive to the indicated use of the "linear non-threshold" hypothesis for calculation of occurrence in low-level effects. This extrapolation hypothesis is itself conservative and the unit generation of effects per dose to be extrapolated downward is also probably conservative. This would tend to indicate that EPA estimates of reduced effects may be high; therefore, any expenditure for control equipment might be significantly less cost-effective than EPA has assumed and some of the stated basic justification for the proposed standards may thus disappear.

It is assumed that implementation and enforcement of the proposed standards by the NRC will be readily achievable. However, the lack of precedent for allocating to specific fuel cycle activities, much less individual facilities, and the inevitable legal procedures, both required and potential, which will ensue might lead to years of regulatory rulemaking and additional litigation. The socio-economic impact of this possibility is not discussed in the DEIS.

3. Use of the Linear Dose-Effect Assumptions.

Statements are presented in the DEIS which, through lack of proper qualification, can mislead the reader as to the theoretical nature of the linear dose-effect hypothesis, which assesses the upper limit of risk but is generally recognized as overestimating the actual effects of radiation.

The linear theory as used in the DEIS is not in agreement with the recommendations of the ICRP (Publication 22, page 13) in that:

> "... the use of a linear relationship derived in this way (as in the DEIS) for assessing the social gain of a dose reduction is less satisfactory, because the linear relationship implies the same social gain from a unit reduction in dose, independent of the level of dose and dose rate.... The linear extrapolation from high doses thus may overestimate the social gains of dose reductions at these low levels of dose and dose rate and may lead to an expenditure of effort not balanced by corresponding social gains."

The NCRP considers the use of "upper limits" in establishing policies to be unreasonable and cautions the use of person-rem versus risk estimations in Report No. 43:

> "The NCRP wishes to caution governmental policymaking agencies of the unreasonableness of interpreting or assuming 'upper limit' estimates of carcinogenic risks at low radiation levels, derived by linear extrapolation from data obtained at high doses and dose rates, as actual risks, and of basing unduly restrictive policies on such an interpretation or assumption."

The philosophy and justification for applying the linear theory to predict harmful effects is not limited to ionizing radiation, as stated in NCRP Report No. 39, underscoring as in the original:

> "... it is a concise summary of the intention [of the as low as practicable provision] to encourage protection practices that are better than any prescribed minimal level, and this is the basic criterion for all cases in which a non-threshold dose-effect either exists or has to be assumed. A similar admonition should be given for many potentially harmful agents and radiation is in no way unique in this respect."

The DEIS does not include this aspect of the linear theory of biological effects, nor does it discuss whether the linear theory should be applied to any materials which might be emitted to the environment by energy generation systems which are alternatives to nuclear energy. The possibility is thus suggested that the proposed rulemaking would apply the linear theory to the nuclear industry in a discriminatory manner. Is there a consistent national policy on, say, fossil fuel utilization, or the use of radiation and radioisotopes in medical practice, or are we proceeding in an ad hoc fashion by individual technology?

4. The Treatment of Health Effects.

The proposed standards are not given proper perspective in the DEIS with respect to ICRP, NCRP, and FRC guidance particularly with regard to their relative health effects. A seriousness of exposure at these low levels is implied but is inconsistent with the ICRP in Publication 22:

> "At low levels of individual dose; e.g., those small by comparison with variations in local natural background, the risk to the individual is so small that his health and welfare will not be significantly changed by the presence or absence of the radiation dose."

and the NCRP, in Report No. 43:

> "At such low radiation levels as are involved in the radiation protection standards, identification and quantification of both risks and benefits are so highly uncertain and imprecise at this time that the practice of balancing risks and benefits numerically is not useful to pursue without far more thorough and penetrating exploration."

These warnings to the reader are not reflected in the "health effects" discussions. More importantly, it does not acknowledge that because of the unproven nature of the linear theory any "health effects" estimation for these low dose rates must always involve a range. Since the effects of operation under present standards may be zero, the claimed benefit of "saving" 1000 "health effects" may be non-existent. The statement further fails to place these estimated health effects in perspective relative to other sources of radiation, such as nuclear facilities located in other countries, worldwide weapons debris, medical exposures, and background radiation.

Health effects estimates require the calculation of dose equivalents and information on dose-response relationships. The calculation of dose equivalents is based on complex theoretical models of distribution and dispersion of radiation and radioactivity. Only recently have attempts at experimental verification been made to show the adequacy of the calculations. It is questionable whether standards should be established on the basis of a theoretical model not yet experimentally verified, especially as it is stated in the proposed rulemaking that "...environmental models used for making these assessments, while useful for making estimates of potential health impact, are not considered to be so well-defined as to allow standards for populations to be expressed directly in terms requiring their explicit use."

Of equal significance is the caution included in the DEIS against ignoring the environmental radiation exposures which are so small as to be undistinguishable from natural background radiation because "this point of view ... neglects ... the point that the radiation doses involved are avoidable man-made doses, not doses due to natural radioactivity." Since a rem, by definition, has the same biological effect no matter what its source, the point of this distinction is not clear. More important, however, is the fact that the DEIS fails to make clear to the reader that natural background radiation is not a uniform quantity, but varies in time and place. By data which EPA itself has published, a change of residence within the United States can involve an annual incremental change in radiation exposure greater than 125 mrem.

The importance and the significance of small exposures with regard to background has been well stated by the ICRP in Publication 22, which has been partially quoted earlier. The methodology used in the DEIS does not recognize the philosophical bases for the ICRP and NCRP standards. The DEIS does set a tone for objective and balanced assessment of the industry's demonstrated ability and record in environmental protection. This tone should be developed as the rationale for the rulemaking. Instead, it is stated that unless standards are adopted, "unnecessary exposure to the public ... and ... irreversible contamination of the environment could result" and that ... "the principal impact of radioactive effluents

on the biosphere is the induction of deleterious effects in man," ... "the ... somatic effects include leukemias, thyroid, lung, breast, bone and a variety of other cancers ...", and "The genetic effects encompass virtually every aspect of man's physical and mental well-being." With no perspective provided, the "health effect" of an equivalent power economy based on some other fuel source cannot be determined.

5. Economic Costs of Implementation.

The basic implementation cost of the proposed standards appears to vary from 0.04 to 0.10 mills/kwh (Figure 3) or much less than 1 percent of the total power costs indicated. Overall economic cost would not therefore appear to be a significant factor (even though the total health benefits are also relatively small). The estimate of $100,000 cost per "effect" reduced (p. 85, line 13 for example) appears compatible with some other costs society now pays for risk reduction. However, it should be noted that page 44 and Figure 4 seem to indicate a tendency to deal with an improved control level breakpoint at or below one-half million dollars per effect. Page 47, lines 11-13, also places the upper limit of societally acceptable prevention-costs at one-quarter to one-half million dollars, and this may be high. Thus the basis for the dollar value estimates should be included. In addition, the concept of basing standards on "best" performance that can be extracted from a control technology appears contradictory to the principle underlying EPA's basic approach in this document (which is to develop the standards in a cost-effective manner and to specify control levels compatible with expenditures that society considers appropriate to reducing other types of risk).

6. Potential Health Effects and Table 10.

According to Table 10, the most significant contributor to health effects is ^{14}C. If the data are correct and the presentation is representative of reality, then a moderate reduction in ^{14}C releases by the development of improved control systems would lead to reduction of population exposures and potential health effects far more substantial than those suggested in the proposed rulemaking.

With regard to the table, it can be seen that if (1) one sums the three columns, (2) recognizes (page 83) that EPA used 170 instead of 500 mrem/yr as the allowable dose to an individual at the site boundary and multiplies the sum of column 1 by 3 to 140,000 effects, that AEC (NRC) Appendix I removes over 90 percent of the "effects" (or 129,000) while EPA's further restrictions remove only 1,000 of them.

Varying the time period chosen for "effect" calculations (100 years) has a large effect on the number of effects, especially from C-14. Also, no credit was given for forthcoming NRC guides for reduced doses at FRP's and other fuel cycle facilities. If this was done the 1,000 effects saved would be further reduced in number.

7. Apportionment of Permitted Dose

Apportionment of radiation guides to various industries, actions, or processes is dismissed rather briefly by the EPA. A limit of 25 mrem per year is being set "on individual doses to members of the public" with respect to short-lived nuclides and gamma radiation from on-site sources. It is stated that this limit can be easily met according to information available on effluent control systems, from environmental impact statements, from operating experience, and from present projections for growth and siting of nuclear facilities. The issue of population definition and the mechanics of dose apportionment is not addressed. Doses due to transportation were not included.

It is concluded that the alternative of using apportionment, "could not provide adequate environmental protection." As standards are reduced and are applied to many parts of the nuclear industry, it becomes difficult to set these standards for one part of the industry without considering its effect on another part of the industry. Apportionment therefore may be a very crucial part of the whole problem, and should be addressed. If exposures from various industries are to be reduced, the effects from these other uses compared to those from nuclear power use should be compared. The concept of risk-benefit calculations and the concept of as low as practicable should apply to each of the industries and to their inter-relationships.

8. Availability of Backup Information

Supporting information or documentation in the DEIS is severely limited. There is no way to trace calculations, step-by-step, from source term to health effect. One is referred to reference 13 (EPA-520/9-73-003), but these documents do not provide sufficient information in general and virtually no information on transuranics. Health effects are derived from the BEIR report, but just how is not explained.

The general dosimetry used in Parts I, II, and III of EPA-520/9-73-003 has been described only briefly and, in particular, the weaknesses and strengths have not been discussed nor has its accuracy been indicated. Some of the dosimetry depends on the adequacy of numbers obtained from ICRP and NCRP documents, a number of which are now under complete review especially with respect to concentration data.

An explanation for the use of a dose conversion factor in units of mrem/yr per pCi/m^3 should be included since it is not clear if this is for a continuous intake situation in which the dose is building up with time, or whether the factor is an average for 1 year, 100 years, or some other time unit.

9. An Expanding Data Base

The difficulty of establishing "as low as practicable" radiation standards with an incomplete and changing data base is recognized. The difficulties are perhaps demonstrated by the internal inconsistencies (e.g., the treatment of ^{85}Kr versus ^{14}C, the apparent use of a dose model but a disclaimer of the value of such models) and the frequent resort to conjecture and unsupported citation (e.g., page 14-paragraph 2, page 15-paragraph 2, page 20-paragraph 2, page 56-paragraph 3, page 89-paragraph 1, and page 93-paragraph 2). These difficulties are compounded by introducing unexplained factors into the procedure for establishing population dose criteria. For example, the basis for using 100 years as the time period for assessing impact is not evident, yet the dose impact of any release (and presumably any health effect) is highly dependent on the time period selected. Where knowledge is incomplete and uncertainties are prevalent, perhaps an infinite time period should be selected. It would appear appropriate to attempt such an estimate in view of the long-lived radionuclides. In addition, the reason for the assignment of the same dose criterion for the whole body and for all organs of the body other than thyroid is not clear. Since the ration of doses to different parts of the body can be quite dependent on the physical form of release and the subsequent pathways and modes of exposure, release criteria may have no consistent relationship to relative organ doses, and criteria based on releases rather than relative radiosensitivity may not be appropriate. For example, the proposed regulations imply a limit of 25 mrem/yr to the pulmonary lymph nodes, which are likely to receive relatively high radiation doses compared with other tissues. The impact of this restriction on the lymph nodes is not considered, and, while Part I (Fuel Supply) of reference 13 states that the "radiation dose to the lymph nodes of the tracheobronchial region will not be used as a criterion for setting environmental standards...," this qualification is not stated in the Draft Statement.

10. Detailed Comments

1. Page 3 - Contamination from weapons testing fallout and that from natural and other artificial sources should be presented for comparison with present and projected contributions from the nuclear power industry.

2. Page 5 - The phrase "fuel cladding is destroyed" is not representative of the processes involved. The basis for this phraseology should be stated.

3. Page 6 - Waste management and decommissioning are specifically excluded from "uranium fuel cycle." This fact should be made clear in the definition in 40 CFR 190.02b.

4. Page 6 and elsewhere - The reassignment of AEC functions to both ERDA and NRC should be made clear.

5. Page 10 - The first sentence implies that deleterious effects on man of low-level radiation are proven. They are only postulated.

6. Page 10 - The reference to "non-specific life shortening" appears to be a questionable one. Since the concept is not incorporated into the risk analysis used to support the proposed standards, and since its significance at the low dose levels under review is questionable, the term should be either deleted or defined so that the public is not led to believe that something threatening has been left unregulated.

7. Page 13 - The statement that "it has become increasingly clear that the current...Guide for...exposure...is unnecessarily high" rests upon unsubstantiated concepts and concerns. This is not the sense of the original remark found in the BEIR report as can be seen in the quote later in the same paragraph. The categorical conclusion that present radiation standards are "unnecessarily high," with the unstated, but implied, conclusion that the standards are set at a level dangerous to the public health and welfare, is scientifically unsound, administrative unwise, and could become economically costly. Technological feasibility and thus the technological capability of meeting scientifically sound standards criteria, and the opposite situation where the standards themselves are unsound and at threatening levels should be differentiated. In both instances, the standards are "unnecessarily high" but only in the second case are they a threat to the public health.

8. Page 14 - The first full paragraph is a weak basis for justifying major expenditures to limit releases of long-lived nuclides, "...may give rise to substantial long-term impacts..." needs quantification.

9. Pages 14 and 15 - The ICRP, NCRP, and FRC have recommended limiting radiation doses to individuals rather than limiting the buildup of quantities of radionuclides. The EPA would reverse this recommendation because the approach is not "specifically environmental." However, they state elsewhere (page 10) that effects on man can be selected as the controlling parameter - that no other species have a "sensitivity sufficiently high to warrant a greater level of protection than that adequate for man." Therefore, dose to man (or health effects) would seem to be appropriate to assess environmental effects.

10. Pages 15 and 21 - Exposure is used when dose is intended. Throughout the report "exposure" is frequently used when "dose" is intended. (The words whole body should always be hyphenated when used as an adjective, such as "whole-body dose.")

11. Page 31 - Figure 2 does not include any reference to the number of fuel reprocessing plants that will be in operation or needed.

12. Page 32 - The next to last sentence says that EPA will assess dose commitment and health effects first, then decide on limits for measurable quantities"...to provide the level of protection indicated." The assessment in later sections of the report does not meet this criterion. No comparison of health effects/benefit versus similar values for alternative power sources are given. According to Table 10 (page 82), ^{14}C may be the primary nuclide of concern. The report does not adequately deal with the wide range of effects shown in this table.

13. Pages 32-33 - Considering only individual dose and excluding population dose for short-lived nuclide emission would appear to eliminate consideration of nearby population densities when siting power reactors.

14. Page 34 - Table 2 is an uncomplete presentation of principal critical organs per radionuclide. For example, the C-14 dose to bone is 4 to 5 times the total body dose per unit intake, bone, liver, and lymph nodes can be considered principal critical organs for plutonium as well as the lung, and skin of the whole body for noble gases as well as whole body.

15. Page 37 - The criteria for selection of rad-waste systems used in figure and for the order of addition of them to plants should be outlined in some detail.

16. Page 38 - If reasonably conservative assumptions as to humidity and atmospheric dispersion are made, the maximum possible annual dose from H-3 released to air is 1 mrem not 3 (i.e., $8x10^{-3}$ kg H_2O/m^3 air, and $5x10^{-8}$ sec/m^3). Thyroid doses should include contribution from H-3, C-14, external irradiation, etc. Transportation doses could be included in this table.

17. Pages 42-43 - Too much confidence in unproved techniques (especially for ^{85}Kr) is applied in an effort to justify the necessary expenditures. On what basis is the "volox" process considered a means of tritium control?

18. Pages 46-47 - It can be questioned whether one can leave "aside moral implication of assigning a monetary value..."; similarly

it can be questioned whether one "can draw upon (experience) for what society has been willing to spend to prevent future losses..." since it would be interesting to determine whether or not society has ever made such a conscious judgment.

19. Page 49 - Alaska and Hawaii are significant geographical situations and at least potential power-consuming regions that have not been considered in environmental statements for nuclear power facilities. This should be mentioned as such facilities would provide significantly different source term locations for both local and world-wide effects compared to locations in the contiguous 48 states.

20. Pages 50 and 51, Table 4 - Why are HTGR's listed in PWR table?

21. Page 54 - Delete midwest fuel reprocessing, also doses quoted for Barnwell were challenged at hearings and conclusions about how low they are (page 57) may not be valid.

22. Page 68 - No standard is proposed for H-3 releases but doses could be relatively significant compared to other nuclides if releases from FRP's are not reduced.

23. Page 69 - Non-consideration of "unusual" conditions may be ignoring the source of the majority of releases, both short- and long-lived, and consequently underestimate both short-term dose and the long-term buildup of nuclides.

24. Pages 70 and 71 - It is simply not true that one of the objectives of the year 2000 study was "to assist the EPA...." This was purely an AEC study for AEC purposes. Also, site boundary doses could be significantly higher than the "Centroid" averages calculated in the year 2000 study.

25. Page 78 - DF of 10 for I* is less than current practice. The Barnwell hearings established a DF of 20 for I-129.

26. Pages 81-85 and Table 10 - The contribution of each of the "controllable long-lived materials" (^{85}Kr, ^{129}I, TRU) to the 1040 health effects should be given, so a proper evaluation of the necessary controls for each can be made. As already noted, they all appear relatively small compared to the 12,000 health effects quoted from ^{14}C. Further, the technical bases for these estimates should be presented.

    EPA does not acknowledge in this table that these values are maximum values as obtained from the BEIR report and that, in all fairness, a "less-than or equal" sign should be placed before each of these numbers. Furthermore, it is quite clear that many of the qualifications in both the BEIR and UNSCEAR reports indicate

that many of these health effects could in fact be zero although they have no evidence for it at the moment.(e.g., BEIR p. 88).

27. Page 83 - It is not clear that all these diseases are specifically genetic, they may have only genetically related components.

28. Page 85 - Although an average value is quoted for the cost of avoiding health effects (H. E.) of $100,000/H. E., risk reduction items are shown in Figure 3, page 37 (discussion on page 44) that have a slope of approximately $500,000/H. E. The methodology in arriving at $100,000/H. E. should be presented.

29. Page 88 - The third sentence in the full paragraph apparently should read "fabrication facility" rather than "reprocessing facility" since costs for reprocessing facilities were estimated in the first sentence.

30. Page 90 - Appendix I to 10 CFR 50 was issued and published in the Federal Register in May 1975.

31. Page 91 - ORNL (HNL) is not the only laboratory doing research on removal of I.

32. Page 93 - There is no assurance the H-3 releases to water would lead to lower individual dose, but same world-wide doses. The source of this statement should be referenced, or calculation provided.

33. Page 94 - Maximum Permissible Concentrations (MPC's) have not been basic standards since the issuance of FRC Guide No. 1; the concept of MPC has long been discarded in favor of "Concentration Guides."

34. Page 95 - Occupational dose is not addressed in the first two paragraphs as a consequence of "effluent control systems."

35. Page 104 - Does the estimate of .3 person-rems include the contribution of world-wide krypton and tritium?

36. Page 127 - The rationale for choosing the 75 mrem/year to the thyroid does not indicate any technical basis for analysis. This rationale should be discussed in the DEIS.

37. Page 131 - The $75 per person-rem derived from the $100,000/per health effect is not discussed in the DEIS. Rationale for its derivation should be presented.

FEDERAL ENERGY ADMINISTRATION
WASHINGTON, D.C. 20461

OFFICE OF THE ASSISTANT ADMINISTRATOR

OCT 2 4 1975

FEA 75-242

Dr. W. D. Rowe
Deputy Assistant Administrator
  for Radiation Programs
Environmental Protection Agency
Washington, D.C. 20460

Dear Dr. Rowe:

This is in response to your letter of June 2, 1975, requesting comments on the proposed EIS on the Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle. Our comments on the subject are presented below.

The Federal Energy Administration finds that the draft statement provides insufficient data, information, or analyses to justify three aspects of the proposed rulemaking.

1. The Environmental Protection Agency expresses considerable confidence that the Nuclear Regulatory Commission will be able to easily modify its Appendix 1 to 10 CFR 50 in order to implement the proposed standards. However, in consideration of the recent Statement of Opinion of the NRC on Appendix 1, the draft statement does not address the basis of this confidence in sufficient detail. The statement should discuss the significance of the differences between the two versions of Appendix 1 (February 20, 1974 and May 5, 1975) as they relate to the proposed rulemaking.

2. It appears that the capital costs estimated for upgrading reactor iodine control systems in the statement (p. 87) are based on cost estimates for reactors in the design stage as opposed to those either under construction or in operation. In addition to the range of estimated iodine control capital

costs provided in the statement, which reflect the varying requirements for different sites, we would anticipate that a range of costs would be found depending on whether a reactor was in the design stage, under construction, or in operation, and that such information would be included in the statement. The statement does not discuss whether or not backfitting of radwaste systems beyond that required by Appendix 1 for generating stations with three or more adjacent reactors that are either under construction or are operating will be required under the proposed standards. The implications to the industry and consumers, if such requirements are determined to be necessary, should be assessed in the statement.

3. We are not convinced that the proposed numerical limits or the data of compliance on release of krypton-85, iodine-129, and the actinides as presently set forth are attainable. The draft statement does not provide adequate information or supporting documentation to show that reliable, safe, and economically proven control technology for these radionuclides will be available to allow compliance with the proposed levels of effluent control by 1983. In addition, information relating to the potential management and public health and safety problems associated with the storage and disposal of retained krypton-85 should be included.

We recommend that EPA expand the statement to include the information necessary to justify its position on these matters. In so doing, the EPA may deem it appropriate to reissue the draft statement for review and comment.

We appreciate the opportunity of reviewing the draft statement and hope that our comments will be useful to you.

Sincerely,

Roger W. Sant
Assistant Administrator
Energy Conservation and Environment